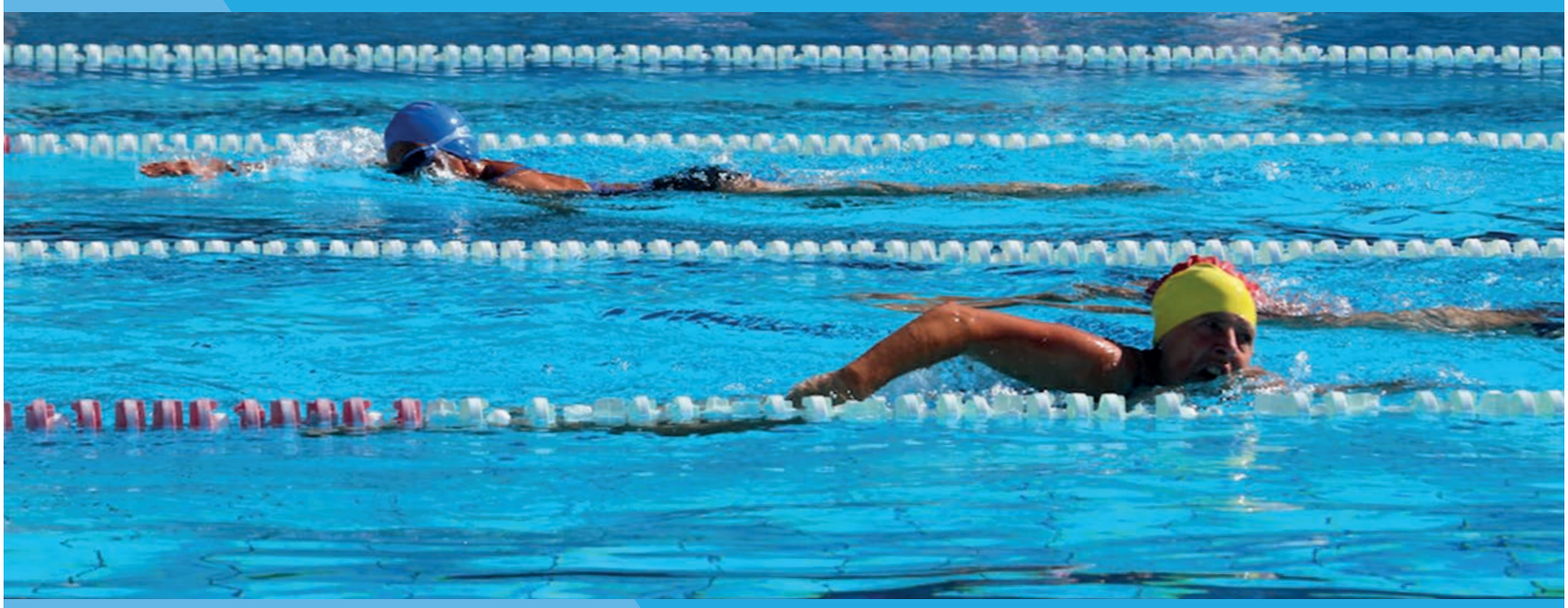
Co-funded by the
Erasmus+ Programme
of the European Union

LIFE LONG SWIMMING

SENIOR SWIMMER'S HANDBOOK



Presentation

The Lifelong Swimming Project (www.lifelongswimming.eu) is co-funded by the EU Erasmus+ Program with the objective of motivating active elderly people (over sixty) to follow suitable and pleasant regular programs that may contribute to their wellness and health.
Additionally, it aims to help and give simple advice and guidance encouraging more adults and seniors to this sport, which can be safely enjoyed by everyone.
The project was originated in Trieste, an Italian city that – for its demographic composition, relevant number of "seniors" and sport associations, a strong sport tradition – can be considered a European "capital of active ageing". FIN Federal Centre Trieste in collaboration with Leader Comunicare Interculture developed in Trieste the first H2Open Days, a format that was then adopted by the project partner countries to promote "lifelong swimming".
The present Handbook has been developed by the collaboration of the Technical Area of the Italian Swimming Federation, the Spanish, Maltese and Turkish Swimming Federations, under the scientific supervision of the University of Coimbra (Portugal) and the support of LEN (Ligue Européenne de Natation) and Leader Comunicare Interculture.

Foundations

The benefits of exercise for individuals of sixty years old and over are substantial and numerous [1]:

- Enhances general wellbeing
- Improves overall physical and psychological health
- Helps preserve independent living
- Lowers blood pressure
- Increases vascular elasticity
- Helps reduce body weight
- Makes the lipid metabolism more effective
- Helps control hypertension
- Improves mood
- Improves sleep quality and quantity
- Stimulates the immune function, improving resistance to infections
- Helps manage painful conditions
- Helps change stereotypic perspectives of old age

It is generally accepted that the time spent exercising for adults aged 60 and above must be [2]:

- At least 30 minutes 5 times a week of moderate-intensity aerobic physical activity;
- *Or* at least 20 minutes 5 times a week of vigorous-intensity aerobic physical activity;
- *Or* a combination of both.

According to the NIH: National Institute on Aging *(National Institutes of Health U.S. Department of Health & Human Services),* exercise and physical activity are very important for older adults for several reasons:

- Can help to maintain and improve the physical strength and fitness.
- Can help improve the ability to do everyday things one wants to do.

- Can help improve your balance.
- Can help manage and improve diseases like diabetes, heart disease, and osteoporosis.
- Can help reduce feelings of depression and may improve mood and over all well-being.
- May improve your ability to shift quickly between tasks, plan an activity, and ignore irrelevant information *(https://go4life.nia.nih.gov)*.

Among the different exercise options, exercising in water could provide additional benefits for senior citizens because it can be used to improve recovery from surgeries, and to gain strength, stamina and balance for daily activities, when supervised by qualified instructors.
Exercise in the aquatic environment, like swimming, is the best choice, since it adds specific benefits resulting from immersion and moving in water [2-5]:

- Reduces risk of injury
- Improves joint mobility with no compounded symptoms of pre-existing articular diseases
- Reduces the need for oxygen (about 10% less)
- Increases conscious breathing (forced exhalation)
- Reduces spine load (streamlined position – buoyancy)
- Facilitates venous return (vascular compression) and increases blood volume.
- Contributes to control hypertension
- Increases energy expenditure contributing for glycaemic control (diabetes). One hour of swimming consumes around 500 to 650 calories.
- Decreases low blood pressure
- Helps increase hand-eye coordination as well as balance
- Improves overall cognitive ability

The LLS Project is sponsored and funded by the EU, developed by the Technical Area of the Italian Swimming Federation in collaboration with LEN, Spanish Swimming Federation and Turkish Swimming Federation, under the scientific supervision of the University of Coimbra (Portugal). More details on the official website www.lifelongswimming.eu.

1. Senior lifelong swimming: an evolutional program

Published research shows that, besides improving significantly stroke mechanics and performance, swimming at a later age also improves overall flexibility, ankle movement, hip rotation, shoulder movement and body mass [6].

The guidelines introduced in our swimming program assume that all candidates are in good physical condition.

Although it seems common sense, before engaging in any exercise program, everyone, regardless of their age, must consult their family doctor to assure that everything is ok and they are able to follow the exercise program without any fears.

This program is based on three basic levels: beginners' intermediate and advanced. The program's concept does not force anyone to make progress. Probably some senior swimmers remain at the second level due to all their experience.

However, the concept is that everyone can learn and improve their swimming skills by adapting the main swimming strokes.

1.1

BEGINNERS LEVEL

This level is suitable for everyone who feels some discomfort or is even afraid of entering the water. Usually the individual moves in the water with some help and at a depth that allows him/her to touch the bottom of the pool.

1.1.1 GENERAL GUIDELINES

- The practices of "aquatic gym" in shallow water (maximum depth 1.40m) can be effective in the beginning. The upright position with head above water helps become familiar with the new element and understand how water reacts to body movements.
- The relaxing activities are very important as they allow you to feel more comfortable, to experiment the buoyancy and discover how easy it is to execute movements helping to balance and to move through water.
- At this level, the program must be oriented to assure self-confidence and a sense of security, to acquire autonomy in the water enabling one to have fun during water activities, and to increase your aquatic competences.
- It is paramount that swimmers feel they can always be helped.
- One does not need to feel a high physical demand. The activity is supposed to require lower intensity and variety.
- The continuity in this level varies a lot. One must not be discouraged by longer continuity in this stage. However, the excessive time spent in this stage could be linked to a lower weekly frequency. Usually a 2 times per week frequency means 6 to 8 months are enough to overcome the initial difficulties.

1.1.2
GENERAL OBJECTIVES

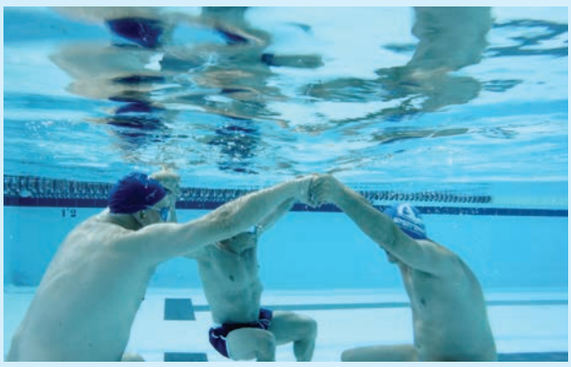
- **Balance**. Stimulating this ability is also required for further movement acquisitions. Some techniques and exercises that come from Yoga, Tai Chi and postural re-education applied in water could play an important role to prevent the risk of falling and hurting.
- **Water walking**. Water buoyancy supports the body's weight, so there is less stress on joints. Water provides 12 times the resistance of air, so as you walk you really strengthen and build muscle.
- **Breathing**. Breath control is the basis of any physical activity. Moreover, working on breathing helps better understand how buoyancy works (inhaling/floating – exhaling/sinking) and promotes relaxation.
- **Static floating** on the chest and on the back. Not all people have a body structure that allows floating: what matters is to maintain the correct position keeping muscles relaxed, so that later you can build complete strokes.
- **Dynamic floating** (gliding). Pushing the ground/wall, perfectly streamlined. Later add the kicking and sculling (extremely useful to develop sense-perception).
- **Entry**. This competence must be introduced very carefully. Many seniors show limitations in this task. The use of access ladders must be the first choice. As soon as conditions allow, entry by foot from deck to water should be introduced. Later, the entry by hands and arms, followed by the head, trunk and legs, will be possible for many senior swimmers.

1.1.3
SPECIFIC OBJECTIVES

- Increasing body immersion, promoting water contact, decreasing gradually the support offered by external aids (fixed or floating equipment)
- Improving a the relaxed attitude
- Promoting the acquisition of static floating with and without help
- Gliding in streamlined ventral/ dorsal position and in lateral body alignment from surface to progressive deeper immersions
- Gliding in streamlined ventral/ dorsal position, switching arm position, taking special care with head and hip position;
- Combining breathing (complete in water exhalation) with rhythmic immersion cycles
- Opening eyes during immersion
- Combining breathing with glide
- Combining breathing with glide and rudimentary propulsion (legs)
- Changing body position when gliding

1.1.4
EXAMPLE OF BEGINNER LEVEL EXERCISES

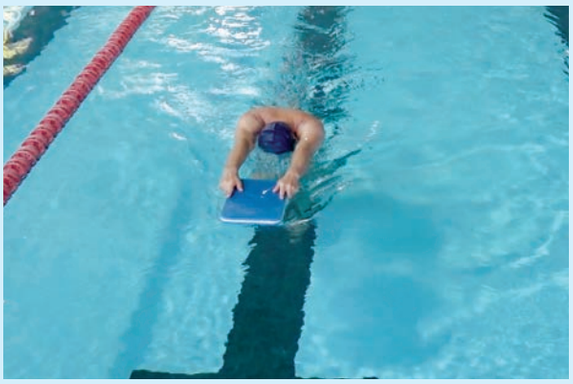
1. Wheel game. Moving continuously, holding hands. At the teacher's signal, all submerge and look to their right and left, smiling underwater.

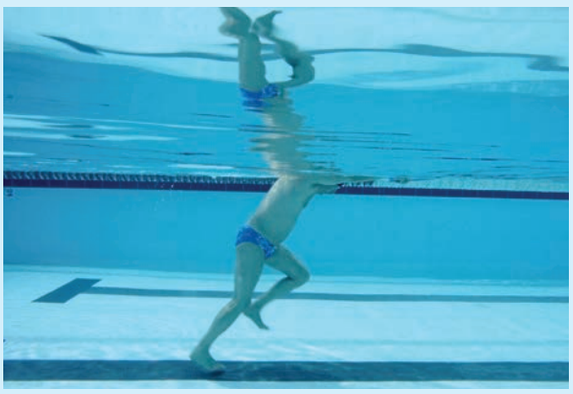


2. In shallow water (chest level) in the same place or in small displacements, running, skipping, hopping or bouncing around, moving arms front and back alternatively and simultaneously, in circles. (In case of deep water the use of an adequate floating aid, is advisable).

3. Shallow water, walking while pushing a ball with the head.

4. Walk with the help of a floating board. At the teacher's signal, immerse the head behind the floating board, and exhale the air through the mouth and nose.



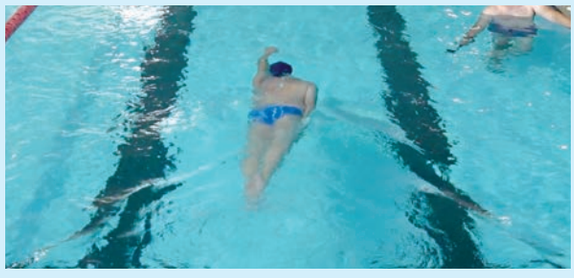


5. Scatter several balls or other objects so that you fetch them and throw them to your colleagues.

6. On the sidewall of the swimming pool, lying on stomach on deck, kick the legs, varying the intensity. Try to keep the legs almost straight (only a small flexion of the knees.

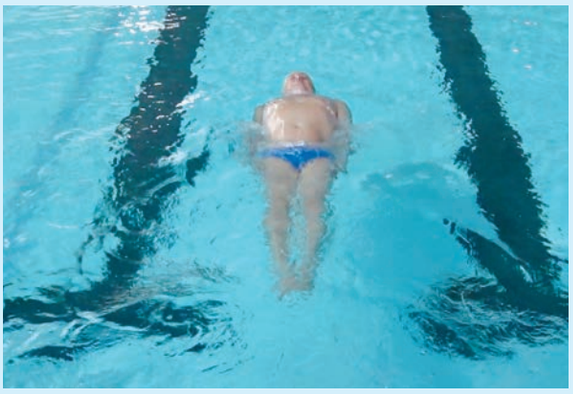
7. In supine (ventral) position streamline position, gliding after push in the wall exhaling during displacements (≈6 meters). Open eyes during the immersion. Four (4) repetitions varying the position of the arms.

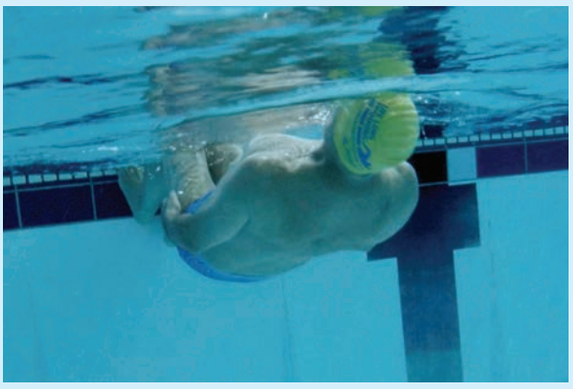
a) Both arms extending blocking the head.
b) One arm extending in front, the other close to the body
c) Change the arms position



8. Gliding prone (dorsal) (≈6 -8 meters). Push from the wall, glide supine keeping the ears and the chin at the surface, eyes looking up to the vertical of the feet. Arms close to the body.

a) Both arms extending blocking the head.
b) One arm extending in front, the other close to the body.
c) Switch arms position.





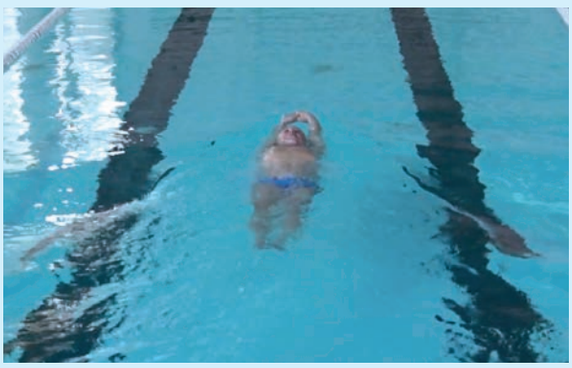
9. In total immersion, after pushing the wall and with the arms along the body, do flutter kicks. When breaking the surface, continue until the need to take a breath.

10. Hold onto the side of the pool, take a breath and hold it, then submerge entire body and exhale making bubbles underwater. Then back to the surface and inspire. Repeat 10times, quickly.

11. In prone streamline position, exhale during glide after pushing the wall.

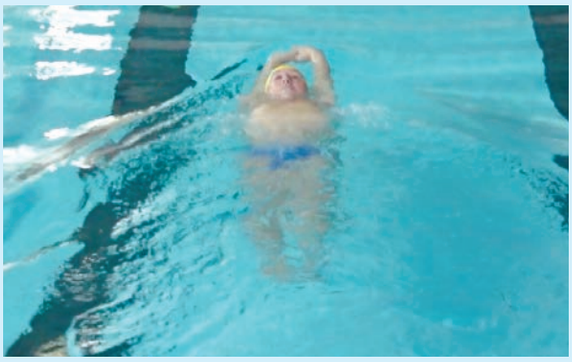
12. Hands on deck, arms in extension, immerse your face, blow bubbles, and then turn the head to one side and inbreathe.

13. Holding a kickboard or noodle, stretch out with chin in the water and glide, by pushing the wall. The same exercise in prone (dorsal) streamline position, gliding after pushing the wall.



14. With head and hands at the edge of the pool, in dorsal position, practice kicking.

15. With hands and feet on the wall, push slowly backwards, shoulders and chin at the surface looking up, glide in streamline.

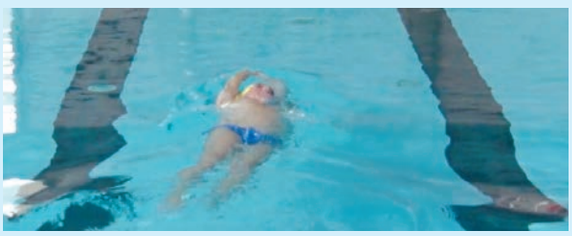


16. One arm holding the flutter kickboard, the opposite close to the body, kick alternatively for propulsion (≈8 -10 meters). Four (4) repetitions switching arm position:

a) Both arms extending blocking the head.
b) One arm extending in front, the other close to the body.
c) Switch arms position.

Kick in ventral position without kickboard, one arm in extension over the head, the other close to the body, turn the head for breathing every 12 kicks. Four (4) repetitions switching arms and breathing side.

17. After pushing the wall, glide at the surface on ventral position, exhale and turn to dorsal position keeping the streamline.



18. Crawl without breathing (≈10 -12 meters), pushing the wall, streamline, and then kick and move the arms alternatively as in crawl stroke.

1.1.5
EXAMPLE OF A BEGINNER LEVEL SESSION

OBJECTIVES: 1. Focusing on streamline position, switching arm position
2. Breathing pattern combined with kick in ventral position

TIME: 45 – 50'

VOLUME: ± 250 meters (to reference purposes only when monitoring the endurance ability progression associated with the swimming skill level increase)

10' / WARM-UP

In shallow water (chest level) in the same place or in small displacements, running, skipping, hopping or bouncing around, moving arms front and back alternatively and simultaneously in circles.
Holding onto the wall, lying on the stomach, kick legs, varying the intensity.

30' - MAIN PHASE

EXERCISE	RECOMMENDATIONS FOR EXECUTION	REPETITIONS
In prone streamline position, glide after pushing the wall, exhaling during displacements (≈6 meters)	Pay attention to the head position, and exhale completely. To return to vertical position first bend knees to chest, feet on the ground and then emerge the face extending the neck. Switch arm position. 1. Both arms extending blocking the head. 2. One arm extending in front, the other close to the body. 3. Switch arm position. 4. Both arms extending close to the body. Pay attention to keep the streamline	4 repetitions for each arm position
Same exercise adding leg propulsion (≈8 -10 meters)	Add the leg kick. Inhale before pushing the wall or the ground and exhale during displacements. Small and quick kicks. Pay attention to keep the streamline	4 repetitions for each arm position
Same exercise with leg propulsion and kickboard (≈10 -12 meters)	Inhale with neck extension, emerging the face briefly and exhale completely in the water. Keep shoulders in place (water line).	4 repetitions

EXERCISE	RECOMMENDATIONS FOR EXECUTION	REPETITIONS
Crawl without breathing (≈10 -12 meters)	Push the wall, streamline, add kick and move the arms alternatively as in crawl stroke. Feel the hold sensation of the palm to apply power. Hold the hand and your body moves through. Feel smooth and easy without struggling with water.	4 repetitions
Glide in supine position (≈6 -8 meters)	Pushing the wall, glide in supine position keeping the ears and the chin at the surface, eyes looking up to the feet, which are in vertical position. Arms close to the body. To switch to vertical position, bend the knees flexing the neck. Feet on the ground and face out of water. (For those who show difficulties in this task, a kickboard on the chest will help).	4 repetitions

10' / COOL DOWN

This is the moment for joy and games, which would be adapted to the swimmers' level. In some cases ball games will be appropriate, in others cooperative displacements (ex. towing partners in different positions).

Research with Parkinson's disease (PD) patients, using the Halliwick Principles' 3-phase 10-point methods for acquisition of aquatic motor skills, shows that the patients improved their ability to float and their longitudinal rotation in bipedal position. The study thus concludes that the activation of the motor control improved the motor skills.

1.1.6 FINAL OBJECTIVES AT BEGINNER LEVEL

- Jumping voluntarily from deck without help (without medical or functional constraints)
- Breathing rhythmically, inhaling from mouth and exhaling in the water from mouth and nose
- Moving in shallow water in different directions or moving in deep water with additional floating equipment
- Gliding in total immersion from wall (5-6 meters)
- Keeping horizontal floating position, and returning to vertical position without help
- Doing the same in deep water with additional floating equipment
- Making a displacement of 12 meters in ventral position with leg propulsion, with floating kickboard
- Making a displacement of 6 meters in ventral or dorsal position, with global contribution of legs and arms, without additional floating equipment
- Floating in ventral position without help, adopting the jellyfish position and returning to vertical position.

1.2

INTERMEDIATE LEVEL

Seniors at this level must show autonomy in the water. Considering security conditions, they are able to choose the appropriate way to entry in the water according to their skill level, they immerge voluntarily and float statically and dynamically (glide) both in supine and prone position. They are able to do some breathing cycles in the same place or during displacements.

1.2.1 GENERAL GUIDELINES

- Considering the necessary individual skill competence at this level and a frequency of 2 times per week, the swimmer is supposed to stay in this stage for 8 to 10 months
- Each lesson takes 45-50'
- The ratio between teacher and swimmers is around 1:10 - 12

1.2.2 GENERAL OBJECTIVES

- Lead seniors to agree to float (any position) in deep water. It is very important that swimmers work safely even when they cannot touch the pool bottom .
- Execute the basic swim techniques crawl and backstroke, which should be developed globally, starting from a raw form to subsequent refinements.
- Associate the correct regular breathing pattern to each stroke.
- The breaststroke kick and the undulatory movement can be introduced at this level.

1.2.3
EXAMPLE OF INTERMEDIATE LEVEL EXERCISES

1. One length with alternating kicking without kickboard (12.5 m ventral position, turn, 12.5 m dorsal position).

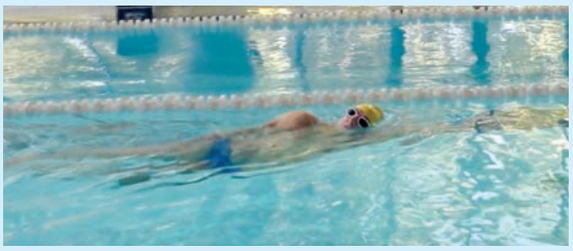
2. One length alternating crawl and backstroke (12.5 m ventral position, turn, 12.5 m dorsal position).

3. Collect objects from the bottom of the pool:

a) In shallow water.
b) Increase the depth progressively.
c) Submerge pushing the wall; displace to collect 2 objects located 3 meters apart.
d) Increase the depth. Submerge pushing the wall of the pool, streamline and collect 2 objects located 5 meters apart.

4. Hold onto the edge of the pool (horizontal position) kick and exhale in the water through nose and mouth.

5. Lateral kicking. One arm close to the body and the other in extension (12.5 m).



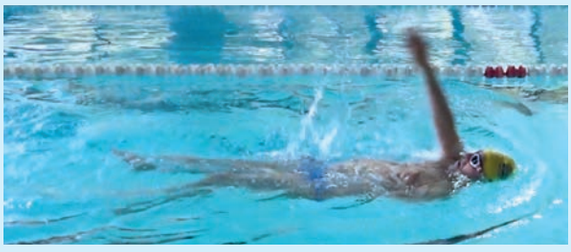
6. Push the wall and glide underwater in streamline position, add 6 kicks, break the surface and add 6 crawl arm strokes without breathing.

7. Push the wall and glide underwater in streamline position, add 6 kicks, break the surface and keep 1 arm in extension in front of the shoulder, execute the alternating kick (crawl), switch side (4 repetitions).

8. Maintain 20" in buoyancy on back position in the same place with the help of floating material (one small kickboard in each hand).

9. Complete backstroke with double arm (25m).

10. 4x25 m: Backstroke with one arm in extension, the other laterally close to the body.

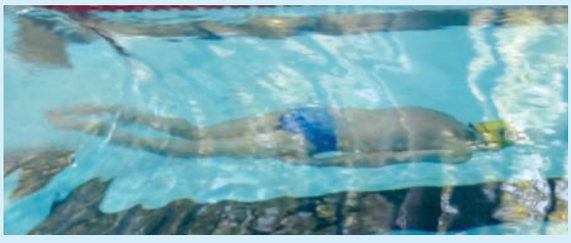


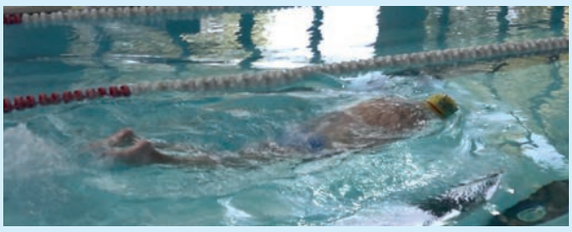
11. 2x25 m: Backstroke catch-up.

12. At the surface, make undulatory movement with the body, hands close to the body, without breathing:

a) First in ventral position.
b) Second in lateral position.
c) Then in ventral position in total immersion.

13. Alternate 6 kicks undulating, 6 kicks in crawl, and normal complete crawl to complete the length.





14. Kick in breaststroke in dorsal position.

a) With kickboard.
b) Without kickboard, hands close to the hips.

15. With kickboard, execute the breaststroke kick in ventral position.

16. Synchronize double arm backstroke with breaststroke leg kick.

1.2.4
EXAMPLE OF AN INTERMEDIATE LEVEL SESSION

OBJECTIVES: 1.Flotation
2. Breathing – focus on water exhalation cycles

TIME: 45 – 50’

5’ / WARM-UP

Hopping in the same place or in small displacements in shallow water (waist level), own shower exercise, keeping eyes open and simply enjoying the activities.

30’ - MAIN PHASE

EXERCISE	RECOMMENDATIONS FOR EXECUTION	REPETITIONS
Walking in water (waist and chest deep)	Different directions (forward, backward, sideways) Without and with the help of the arms (simultaneously and alternatively)	10’
Walking in water (waist and chest deep), shoulders at surface level	With kickboard or another flutter device, mouth immerse, blow near the surface, eyes open	10’
Walking in water (waist and chest deep) with trunk in horizontal position	With kickboard or another flutter device, immerse the face, blow underwater, eyes open	10’
Walking in shallow water pushing a ball with the head	Every time someone pushes the ball, he or she must put his or her face in the water	5’
Series of total immersion of the body in the same place, exhaling the air through the mouth	In pairs, or with the help of the teacher, control the breath cycle	5’

10’ / COOL DOWN

An adapted ball game.

1.2.5
FINAL OBJECTIVES AT INTERMEDIATE LEVEL

- Jumping from deck (if there are no contraindications) and returning swimming to the wall.
- Swimming 25 meters in crawl using legs and arms, breathing regularly
- Swimming 25 meters in dorsal position using legs and arms, breathing regularly
- Complete submersion to catch one object (with eyes open) at least at 1.5m deep
- Swimming 12.5 meters in ventral position, turning 180º and swimming 12.5 meters on back position
- Swimming 12.5 meters with breaststroke kick, with kickboard
- Swimming 12.5 meters in undulatory movement in ventral and dorsal position

1.3

ADVANCED LEVEL

1.3.1 GENERAL OBJECTIVES

- Continuing the crawl and backstroke improvement.
- Breaststroke. It is a fundamental stroke, since it allows swimming underwater and it is easy to learn in its elementary form: for most swimmers it is the most instinctive technique, so it could be the first stroke to be learned by people with poor buoyancy or physical limitations (i.e. difficulties in arm rotation).
- Butterfly. It is essentially a useless stroke and it should be learned only by full-healthy swimmers with a competitive attitude (masters swimming).
- Other strokes/techniques: all water sports techniques can and should be taught. Bicycle kick, sculling, rescue swimming skills, and underwater breaststroke are especially useful.
- The bio motor skills should address mainly general endurance, specific muscular resistance and, to a lesser degree, swimming speed.

Since swimmers may show some technical flaws and lower aerobic capacity, interval training with short to medium intervals (50-200 meters) with brief rest recovering times (15" – 2/3') is recommended.
Drills and legs can be used in this kind of work.
If possible, the workload intensity can be checked by monitoring the HR (pulse meter or hand palpation), or by using the Rating of Perceived Exertion (Borg scale). The HR must be between 50-70% HR max.

Control heart rate (HR) with a heart rate monitor and counting manually

RATING	DESCRIPTION
0	**Rest**
1	**Very, very easy**
2	**Easy**
3	**Moderate**
4	**Somewhat hard**
5	**Hard**
6	
7	**Very hard**
8	
9	
10	**Maximal**

Ratio scale categories of perceived exertion *(adp from Borg, G, 2000)*

1.3.2 METHODOLOGY

Each lesson or training session of 45-60 minutes must focus on a maximum of two swimming techniques and generally should be composed of:

- General warm-up. Usually with some exercises on deck aiming to explore cardio vascular stimulation, articular amplitude and general strength (lower, upper body and core exercises) (about 5 -10').
- Specific warm-up. Swimming drills using exercises from the last session (10-15').
- Main part. Exercises related to the main objective of the session (20-30').
- Recovery or cool down. Ludic activity with lower intensity (5').

EXAMPLES OF TASKS FOR TECHNICAL WORK IN CRAWL (FREESTYLE)

1. One arm in extension over the head, the other close to the body, execute lateral kick switching side every 12 kicks (keeping the streamline).

2. Leg kick in ventral position without kickboard, switching intensity (strong / slow every 5 m), breathing laterally, pushing one arm to the hip, and recover underwater.

3. One length (25m) with one arm doing the arm stroke, the other staying in extension over the head (without kickboard and keeping the streamline). Breathing every 3 strokes. At the following length switch side.

4. The same exercise with one arm swimming while the other is close to the body. Breathing every 3 strokes in the opposite side of the working arm. Focus on body roll.

5. Normal Crawl stroke, long strokes, streamline, breathing every 2, 3, 4, 5 arm strokes.

EXERCISES FOR BACKSTROKE

1. Kick sideways, head over the extended arm, the other arm close to the body. Switch side every 12 kicks.

2. Kick with one arm extended over the head, the other arm pointing in vertical direction, hand facing out. Switch arm position every 12 kicks, completing the arm stroke.

3. Swim with one arm, pull the shoulders when rolling. When the hand enters the water, the opposite shoulder rises. Switch side in every lap.

4. Swim backstroke with the goggles in balance placed on forehead.

5. During two series of 6 kicks, while counting mentally, exercise the arms as follows: one hand enters on first kick, the other arm on the fourth.

EXERCISES FOR BREASTSTROKE

1. In ventral position, with kickboard, count the number of kicks and try to reduce them in every lap.

2. In dorsal position, kick touching simultaneously the heels with the fingers.

3. With pull buoy make small arm strokes in seated position, moving forward.

4. Synchronize one arm stroke with the breathing followed by 3 kicks (streamline).

5. Arms in crawl with legs in breast, synchronizing one kick for every arm stroke.

EXERCISES FOR BUTTERFLY

1. Undulating in dorsal position.

2. Undulating in the same place in vertical position maintaining the head out of the water (series of 10"/ 20" rest).

3. Synchronize one arm with two kicks. Place the entry in the first kick and second kick immediately before the hand leaves the water.

4. Execute the pull and the recovery phases of the arms, both underwater. Place the breathing at the end of the second arm stroke.

5. Alternate 8 cycles of butterfly normal stroke, with 8 cycles of crawl stroke.

1.3.3
EXAMPLE OF AN ADVANCED LEVEL SESSION

OBJECTIVES: a. Technical corrections
1. Arm recovery in crawl
2. Breathing coordination with arm stroke (crawl)
3. End of propulsive phase of the legs (breast)
4. Coordination of breaststroke

b. General endurance

TIME: 50 – 60'

VOLUME: ≈ 1,300 meters (to reference purposes only when monitoring the endurance ability progression associated with the swimming skill level increase)

10' / WARM-UP

5' - General activation on dryland Callisthenic exercises aiming to increase body temperature

20' - SPECIFIC WARM-UP

TIME	TASK	OBJECTIVE
4' or 200 meters 4 x 25 metres (Crawl/Breast) / 20" 4 x 25 (Crawl/Breast)/ every 1' 100 meters easy	Swim easily, increasing smoothly the propulsive force applied. During the odd numbers of length kick only, during the even numbers of length swim normally. 12.5 hard + 12.2 easy	Specific warm-up.

30' - MAIN PHASE

EXERCISE	RECOMMENDATIONS FOR EXECUTION	OBJECTIVE
4 x 25m one arm (with kick-board)/ 20"	One arm surf stroke. Switch side every lap. Control the high elbow position during recovery.	High elbow position on the recovery phase of the crawl stroke.
4 x 25m one arm (recover underwater)/20"	Switch side every lap. Pay attention to inhalation when the hand approaches the hip and the shoulder roll. The face must return to the water before the hand is under the chest underwater during recovery phase.	Synchronization of breathing with arm stroke.
3 x100 / 1' 4 x 50 / 30	Try to maintain the same number of strokes in every lap.	Endurance HR. (60-70% HRR).

3' / COOL DOWN

100 meters (slower every 50 metres)

2. Dryland workout

In general, dryland training is beneficial for seniors. Intermediate and advanced swimmers will often benefit from dryland exercises requiring strength or flexibility, since these help them to become conscious of the movement pattern they do while swimming. Such motion awareness helps them correct postures and flaws.
Proper supervised strength and flexibility program in separate sessions may be very useful to overcome some muscular and flexibility weakness. However, it must be questioned if this is really necessary since the swimming program may, by itself, solve eventual weaknesses [4].
Nevertheless, a proper warm-up or recovery routines must be part of the program at every level ensuring that the best physical and emotional conditions are right for the workout. The following is an example of a warm up routine.

2.1 DRYLAND WARM UP: 10 MINUTES

Warm up is aimed to improve articular mobility and prevent injuries.

2.1.1 GENERAL MOBILITY (FROM BOTTOM TO TOP OF THE BODY)

- Flexion and extension of ankles.
- Flexion and extension of knees.
- Hip rotations with necessary caution.
- Flexion and extension of elbows.
- Flexion and extension of wrists.
- Shoulder rotations.
- Neck rotations.

2.1.2 SCAPULAR MOBILITY

- Scapular push-ups using wall slides.

2.1.3 IN CASE OF OSTEOPOROSIS

- Facing wall
  - With knees slightly flexed, push the wall with the hands keeping the back straight.
  - Climb the wall with the hands until getting full extension of arms and back.
  - Half flexion of knees with the hands resting on the wall above the head level. Up and down slowly.
- Back to the wall
  - With feet slightly away from the wall push up the body against the wall and stretch the body as far as possible keeping the back straight and the knees slightly flexed.
  - With the hands resting on the wall, do half flexion of knees keeping the back straight. Up and down slowly.

2.2 STRETCHING EXERCISES: 10 MINUTES

Stretching should not cause pain or serious fatigue: there may be some discomfort that goes away when tension is released, but there should be no pain.

2.2.1 BASIC GUIDELINES FOR EXERCISES

- Start slowly. It has taken years to get this stiff. It's not going to be fixed in a day.
- Drink plenty of fluids unless doctor has advised you against this.
- Don't hold breath during stretching. Relaxed breathing helps muscles relax.
- Always be aware of the position of spine. Any extremes in curvature can make it vulnerable to injury.
- Warm muscles briefly prior to stretching by taking a short walk or using some light dumbbells.
- Avoid bouncing or ballistic stretching
- Hold each stretch for 60 seconds for maximum benefit

3. Swimmers' certification

Upon registration, seniors receive the Swimmer's Book, which seniors must carry with them for the entire swimming program. In this Book, the swimming school coordinator records the technical and the chronometric progress made by the senior.

BEGINNERS' LEVEL		
	YES	NO
Full immersion (with eyes open)		
Breathing		
Static floating		
Dynamic floating		
Vertical floating (any technique)		
Streamline on the chest (with kicking)		
Streamline on the back (with kicking)		
Sculling on the chest		
Sculling on the back		
Jump diving (without constraints, any technique)		

INTERMEDIATE LEVEL		
	YES	NO
Jump from deck (if there are no contraindications) and return swimming to the wall.		
Swim 25 meters in crawl using legs and arms, breathing regularly		
Swim 25 meters in dorsal position using legs and arms, breathing regularly		
Complete submersion to catch one object (with eyes open) at least 1.5m deep		
Swim 12.5 meters in ventral position, turn 180º and swim 12.5 meters on back position		
Swim 12.5 meters with breaststroke kick, with kickboard		
Swim 12.5 meters with undulatory movement in ventral and dorsal position		
Vertical floating (bicycle kick)		
25m backstroke (full stroke – with start and underwater dolphin kick)		
25m freestyle (full stroke – with start and underwater dolphin kick)		

ADVANCED LEVEL		
	YES	NO
50m backstroke (with flip turn)		
50m freestyle (with flip turn)		
25m breaststroke (full stroke – with start and underwater stroke)		
25m butterfly (full stroke – with start and underwater dolphin kick)		
100m individual medley		
25m underwater		
25m rescue technique (on the chest)		
25m rescue technique (on the back)		

4. Nutrition and hydration

Advice for seniors engaged in the swimming program

Nutritional advice may be offered for those who require it at the swimming pool, during the week, by experts in nutrition.

However, some guidelines are included in the present handbook.

4.1 GENERAL GUIDELINES ON NUTRITION

Energy requirements usually decline with ageing. In fact, such requirements can be estimated using several equations that include age as a factor. This is the most important variable, so predictions for energy expenditure that take into account physical activity have also been developed [7-9]. Thus, total energy expenditure (TEE) is comprised of Basal Metabolic Rate, Thermic Effect of Food, and Physical Activity. The amount and type of dietary energy intake depends on the amount and type of exercise performed and seasonal variations in exercise load. However, most of the dietary energy should come from carbohydrate sources, with other energy sources being consumed mainly to supply the body with other important nutrients like amino acids, healthy fats, vitamins, minerals and water [10].

4.1.1 CARBOHYDRATE NEEDS

Carbohydrates are the body´s main energy source and are predominantly stored in muscles as glycogen. Small amounts are also stored in the liver. Their main function is to regulate blood glucose levels. Exercise performance depends on the availability of carbohydrates, so fatigue and poor exercise performance are often associated with low carbohydrate intake [11]. According to the guidelines shown in Table 1 for training and competition of ageing athletes, for moderate training of 1h/day up to 5-7g/kg BM/day of carbohydrates are recommended. For lower exercise loads 3-5g/kg BM/day are enough to supply the extra energy that the exercise demands. Note that body mass (BM) should actually represent the lean body mass, the total body mass minus to-

tal body fat mass. Choosing whole grain breads and cereals, fruits, vegetables and low fat dairy foods, will provide quality carbohydrates to fuel exercise while providing micronutrients at the same time.

A light snack (for example a cereal bar) 1h prior to exercise will allow sufficient time for food and fluid digestion and absorption, avoiding any gastrointestinal complications during exercise and at the same time providing the body with carbohydrates to support rapid energy supplies before the exercise session, helping maintain blood glucose levels. After exercise, the recovery of the glycogen stores in the muscle and rehydration are important, so nutrient rich fluids like milk shakes and fruit juices should be the main type of fluids consumed after exercise. Sets of simple recipes for recovery drinks are annexed.

4.1.2
PROTEIN NEEDS

Protein consumption is important for maintaining and stimulating muscle protein synthesis. Consuming 15-25g of high quality protein (i.e. protein that provides all of the essential amino acids) about 1 hour before exercise could be beneficial. Older people are encouraged to consume lean sources of protein in order to keep the saturated fat intake low, since the risk of cardiovascular diseases increases with age. Lean protein sources include poultry, lean cuts of beef or pork, eggs, low-fat milk, yogurt, soy, nuts, dried beans and peas and grain quinoa.

Aging results in lower cutaneous synthesis of Vitamin D and lower circulating levels. Calcium absorption also decreases with age, so increasing calcium intake (1000mg/day may reduce bone loss) is important for bone health. The levels of vitamin B6 and B12 also seem to decrease with age. Vitamin D is critical for calcium regulation and recent studies[12] suggest that it is also important in exercise, with VitD levels being inversely associated with poor performance on hand grip strength. Naturally, the main sources of good Vitamin D are cod liver oil and fatty fish, so a supplement that provides 400IU of VitD could be useful in maintaining serum Vit D levels during ageing.

4.1.3
ENERGETIC COST OF SWIMMING

Master swimmers spend their training time in more demanding energetic tasks. Their intake caloric needs are associated with the swimming speed and the exercise load, but also with the stroke technique used.

Taking energy expenditure for a given speed into account, front-crawl is the most economical stroke, followed respectively by the backstroke, butterfly stroke and lastly the breaststroke [13].

4.2 HYDRATION

Ageing decreases the sensation of thirst in response to both hypo and hypervolemia, changes sweating rates, alters blood flow response and brings about renal adaptation to altered fluid and electrolytes. Alcohol and coffee could also contribute to dehydration in older people. Therefore, elders who exercise should not rely on thirst to stay hydrated. Additionally, exercises like swimming could entail some health threats to this population. The saturated environmental and warm conditions make them prone to dehydrate. Strategies to keep a proper hydration include monitoring urine volume and urine colour to determine if one is dehydrated, replace fluid losses after exercise, eat food with high water content (fruits and vegetables) and drink during meals.

Nutrient rich fluids should be consumed after exercise, in small but frequent amounts, until urine becomes relatively clearer. These will help provide the body with carbohydrates, proteins, electrolytes and fluids, all of what is needed to get the greater benefits from exercise.

Urine color scale
(Adp. from Armstrong, 2000)

Seniors must be warned to avoid these three main signs of dehydration:

- **Thirst:** "If you feel thirsty, you're already dehydrated." However, this is not easily detected by individuals, so it is very important to tell seniors to drink before, during and immediately after exercise.
- **Urine Colour:** Urine colour charts in locker rooms may help seniors assess their hydration level, which could be a reminder to drink fluids.
- **Weight:** Pre- and post-exercise body weight could also be a good indicator to identify dehydration after exercise. For every 0.5 Kg of weight loss, there is a need of 500 mL of fluid in order to rehydrate.

4.3

MACRONUTRIENT RECOMMENDATIONS FOR AGEING ATHLETES

CARBOHYDRATE	PROTEIN	FAT
3-5g/kg/day for low intensity or light training	1.0-1.7g/kg/day with protein at the higher end when energy intake is restricted or a strength training program is in the initial stages	20-35% total energy.
5-7g/kg/day for moderate training of 1h/day		
6-10g/kg/day for moderate intensity training of 1-3h/day		
8-12g/kg/day for ultra-endurance training and high intensity training for 3-4h/day		

(Adapted from Chapter 30, Sports Nutrition, Ed. R. J. Maughan, 1st edition. Published 2014 by Jon Wiley & Sons, Ltd.)

5. QR table Senior Swimming Program LLS

BEGINNERS LEVEL WORKOUTS

N°	EXERCISES NAME	QR
01	Playing with balls	
02	Wheel game	
03	Water displacements	
04	Pushing ball	
05	Breathing walking	
06	Kicking on the wall	
07	Gliding in front position	
08	Gliding in back position	
09	Gliding and displacement in front position with kicking	
10	Breathing at the wall in static position	
11	Streamline gliding in front position	
12	Kicking in front position on the wall	
13	Breathing under water	
14	Gliding in front/back position with kickboard	

N°	EXERCISES NAME	QR
15	Kicking in back position on the wall	
16	Streamline gliding in back position	
17	Kicking with kickboard adding the movement of arms	

N°	EXERCISES NAME	QR
18	Kicking and breathing	
19	Streamline gliding and changing body position	
20	Crawl with streamline gliding	

INTERMEDIATE LEVEL WORKOUTS

N°	EXERCISES NAME	QR
01	Submerging to collect objects	
02	Alternative kicking changing body position	
03	Combination crawl & backstroke	
04	Kicking & breathing against the wall	
05	Lateral kicking	
06	Streamline gliding, kicking and swimming crawl	
07	Streamline gliding & kicking	
08	Buoyancy	

N°	EXERCISES NAME	QR
09	Double arm backstroke	
10	Backstroke with one arm	
11	Backstroke	
12	Undulatory movements	
13	Crawl transition from undulating to alternative kick	
14	Breaststroke dorsal kicking	
15	Breaststroke ventral kicking	
16	Double arm backstroke with breaststroke kicking	

ADVANCED LEVEL WORKOUTS

N°	EXERCISES NAME	QR
01	Crawl - lateral kicking	
02	Crawl - kicking & lateral breathing	
03	Crawl – swimming with one arm	
04	Crawl - swimming with one arm and breathing opposite side	
05	Crawl – swimming with diferent breathing patern	
06	Backstroke - lateral kicking	
07	Backstroke - dead point in recover	
08	Backstroke – swimming with one arm	
09	Backstroke – swimming with balance	
10	Backstroke – kicking coordination	
11	Breaststroke – ventral kicking with efficency	
12	Breaststroke – dorsal kicking	
13	Breaststroke – stroke in seated position	
14	Breaststroke – breathing coordination	
15	Breaststroke – crawl with kicking breaststroke	
16	Breaststroke – swimming with eficiency	
17	Butterfly - undulating in dorsal position	
18	Butterfly – vertical undulating	
19	Butterfly – swimming with one arm	
20	Butterfly – recover underwater	
21	Butterfly – swimming alternating with crawl	

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