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Class Design 50+: The Physiology of Aging

CARDIOVASCULAR SYSTEM

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POSSIBLE PHYSIOLOGICAL CHANGES ASSOCIATED WITH AGING	SIGNIFICANCE OF THE CHANGES TO DAILY FUNCTIONING	IMPLICATIONS OF THESE CHANGES FOR AQUATIC EXERCISE DESIGN	SPECIFIC BENEFITS OF AQUATIC EXERCISE
▪ Decrease in elasticity of major arteries and veins. ▪ Decrease in maximum heart rate and stroke volume. ▪ Narrowing of blood vessels in muscles, heart and other organs. ▪ Occlusion of coronary arteries due to fatty deposit (atherosclerosis) and hardening of the arteries (arteriosclerosis). ▪ Decrease in heart valve function due to fibrotic changes in heart valves. ▪ Deterioration of venous valves affecting blood flow to heart (varicose veins). ▪ Stiffening of heart wall, decreasing contractile strength of heart muscle (part of heart muscle is replaced by connective tissue). ▪ Note: "Mental sclerosis" is hardening of the attitude?	1) Impaired ability of the heart to pump blood. 2) Smaller and less efficient system of delivering oxygen to working muscles leading to ischemia (lack of oxygen in tissues). 3) Earlier onset of fatigue and longer recovery rte during both sub maximal and maximal exercise. 4) Increase in peripheral resistance to blood flow therefore the hear must work harder to push blood into circulation. 5) Decrease in circulation to skin and extremities therefore quality of temperature decreases with increased sensitivity to heat and cold. 6) Increase in blood pressure (BP) and slower circulation leading to hypertension and swelling of lower extremities (edema). **7)** Increase in systolic blood pressure (BP) at rest.	1) Always screen participants with respect to Cardiovascular and Respiratory conditions. 2) Have general knowledge of each of your participants from a health and wellness perspective. 3) Keep your Professional Fitness Leadership Certification; CPR and First Qualifications current. 4) Know the Emergency Action Plan at each facility that you teach (EAP). 5) Use the three P's of leadership as a guideline for teaching: permission, protection, pleasure. 6) Ensure gradual progression in exercise intensity. 7) Teach participants self responsibility: 1) how to monitor their own exercise intensity 2) how to change any movement to suit their needs 8) Monitor, evaluate and modify intensity. 9) Look for signs of exertion: 3) Shortness of breath 4) Loss of coordination 5) Dizziness or nausea 6) Chest or arm pain **10)** Avoid arms out of water during warm up and workout phase.	1) Improves aerobic capacity (the ability to absorb and to deliver oxygen to the working muscle). 2) Improves work capacity leading to later onset of fatigue; and decreased sub maximal heart rate at a given workload. 3) May decrease systolic blood pressure at rest and during exercise. 4) Improves recovery rate and improves peripheral circulation. 5) Magical properties of water have a positive affect of the mind, body and spirit: 6) Hydrostatic pressure enhances venous return. 7) Buoyancy dramatically decreases the effects of gravity, thus enhancing venous return and also decreases the amount of joint compression facilitating increased range o motion. **8)** Thermal Conductivity whisks excess heat away from body. **9)** Turbulence massages body promoting circulation.

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RESPIRATORY SYSTEM

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POSSIBLE PHYSIOLOGICAL CHANGES ASSOCIATED WITH AGING	SIGNIFICANCE OF THE CHANGES TO DAILY FUNCTIONING	IMPLICATIONS OF THESE CHANGES FOR AQUATIC EXERCISE DESIGN	SPECIFIC BENEFITS OF AQUATIC EXERCISE
1) Decrease in vital capacity as chest wall stiffens due to decrease in elasticity of lungs. This stiffening leads to loss of recoil in lungs and chest wall. Maximum ventilation decreases. 2) Decrease in diffusion of respiratory gases (oxygen & carbon dioxide) due to decrease in surface area of alveoli. Therefore decrease in ability to transport oxygen and use it at the cellular level in the production of energy required for muscle activation. 3) By age 75, 80% of maximum oxygen uptake (V02 max) is lost. 4) Weakening of the respiratory muscles. 5) Increase in residual volume of air in lungs	1) Overall decrease in aerobic capacity affecting the ability to perform daily activities such as stair climbing, walking, gardening. 2) Shortness of breath with mild exercise. 3) Increase in cost of breathing - the expiration phase of respiration is difficult. 4) Increase in frequency of breathing during exercise versus and increase in tidal volume for ventilation. 5) Common problems include bronchitis, emphysema, wheezing and general shortness of breath.	1) Strengthen respiratory muscles by encouraging participants to take fuller and deeper breaths during exercise. 2) Improve posture with exercises that strengthening and stretch the postural muscles appropriately. 3) Begin with a longer warm up with gradual progressions including all major joint actions and muscles to allow time for oxygenation of blood and flow to the working muscles. 4) Teach participants self responsibility for their own workout. 5) Encourage full breaths with visual and verbal cues including open chest, shoulders back and down, long back.	1) Most common problems with the respiratory system are improved with moderate exercise. 2) Improves vital capacity. 3) Improves maximum ventilation. 4) Improves recovery rate and improves peripheral circulation. 5) Strengthens respiratory muscles. 6) Improves functional capacity resulting in more energy to complete daily living activities with greater energy reserve for additional activities. 7) Hydrostatic pressure makes the respiratory muscles work harder. Note: Participants with severe respiratory challenges resulting in significantly reduced lung volume may need to exercise in chest depth water and avoid immersion to the shoulders.

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CENTRAL NERVOUS SYSTEM

POSSIBLE PHYSIOLOGICAL CHANGES ASSOCIATED WITH AGING	SIGNIFICANCE OF THE CHANGES TO DAILY FUNCTIONING	IMPLICATIONS OF THESE CHANGES FOR AQUATIC EXERCISE DESIGN	SPECIFIC BENEFITS OF AQUATIC EXERCISE
1) Decrease in number of nerve cells. 2) Decrease in blood supply to nerve cells. 3) Decrease in capacity of nerve cells to send impulses to body.	1) Impaired sensory perception. 2) Decreased speed of decision making. 3) Decreased ability and decreased speed of motor response. 4) Increased cautiousness. 5) Decreased ability to recover from imbalance therefore increase in number of falls. 6) Decrease in kinesthetic awareness (ability to gauge movement and position). 7) Decreased equilibrium and coordination. 8) Decreased function. 9) Decreased self esteem with anxiety about learning new skills. 10) Decreased freedom of movement - rigidity related to insecurity. Note: The number one fear of older adults is a fear of falling. Notice the 'cycle of inactivity' that can result, if the affects of aging are 'allowed' to take the 'upper hand'.	1) Allow time for the participants to respond to verbal and visual cues. 2) Educate slowly through fit tips. 3) Include a reasonable number of repetitions. 4) Include a pause between technique cues to enable time for assimilation of each cue. 5) Avoid activities that may lead to collision or falls. 6) Indicate the value of an exercise in terms of improving daily living (movement is meaningful - this is motivation in itself) 7) Remove obstacles from the exercise environment. 8) Demonstrate each component of an exercise clearly and concisely. 9) Ensure participants are spaced a suitable distance apart to avoid body contact and limiting range of motion for 'fear of body contact'. 10) Incorporate effective yet basic steps as transition movements between exercises. 11) As a general rule, change one quality of the movement at a time: ▪ Speed and Range of motion ▪ Leg and Arm movement ▪ Direction and Intensity options	1) Stimulates the central nervous system with movement, music and social interaction. 2) Provides mental stimulation. 3) Improves dynamic and static balance. 4) Improves agility and mobility. 5) Improves body awareness (kinesthetic sense). 6) Improves coordination. 7) Provides opportunities for social activities outside of the class. 8) Improves self confidence. 9) Provides a support system. 10) Provides encouragement and motivation to continue exercising. 11) Improves performance in other activities: ▪ Golf, Tennis, Lawn Bowling ▪ Walking and hiking ▪ Playing with grandchildren ▪ Swimming ▪ Bike Riding and rollerblading ▪ Skiing ▪ Baseball ▪ Badminton ▪ Other leisure activities. 12) Opportunity to interact with people of all ages, not only older adults.

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EYES AND EARS

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POSSIBLE PHYSIOLOGICAL CHANGES ASSOCIATED WITH AGING	SIGNIFICANCE OF THE CHANGES TO DAILY FUNCTIONING	IMPLICATIONS OF THESE CHANGES FOR AQUATIC EXERCISE DESIGN	SPECIFIC BENEFITS OF AQUATIC EXERCISE
1) Decrease in ability to see, especially in conditions with a "glare" such as reflection off water in a pool environment. 2) Decrease in peripheral and depth perception. 3) Decrease in hearing and vision.	1) Decrease in ability to focus on objects. 2) Decrease in attention span, if one cannot hear and see clearly. 3) You will notice the following signs exhibited by a participant if hearing loss is occurring: ▪ Complaints that others are mumbling ▪ Turns one side of head towards sound ▪ Hears ringing and other noises ▪ Finds high pitched sounds irritating ▪ Feels off balance	▪ Pay attention to where you are standing on deck and to the back drop behind you. Is there too much clutter, can you be seen by everyone in the class? ▪ Evaluate your cuing skills: how effective are your cues? For example, when preparing for a change in a movement and using a visual count down: "4, 3, watch my..." ▪ Is your hand held high with the palm facing the participants? ▪ Are your fingers spread far apart to clearly show the count? ▪ Is the signal dramatic enough to convey the message you want? ▪ Select music that enhances the movement experience and motivates older adults to move. ▪ Play the music at an appropriate volume and adjust the sound quality (bass and treble accordingly) ▪ Suggest use of the pool wall if added support is required to maintain balance and remain confident. ▪ Wear bright colours. ▪ When delivering verbal cues, speak slowly and clearly.	▪ If visual cues are used effectively, then participants will understand the movements, learn how to execute the movements safely and gain confidence as they continue to attend classes and progress in their motor skill and fitness levels. ▪ The water is forgiving. If one loses balance, the worst thing that can happen is "the hair gets wet" (assuming a strong lifeguard program is in place). This eliminates the "fear of falling anxiety" that many older adults experience. ▪ Participants who lack confidence while moving in water have the option to hold on to the edge of the pool for extra stability.

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MUSCULO-SKELETAL SYSTEM

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1) Loss of isometric and isotonic (concentric and eccentric) muscle contraction. 2) Loss of speed and power of muscular contraction. 3) Decrease in elasticity and stability of muscles, tendons and ligaments. 4) Decrease in muscle tonus. 5) Decrease in muscle mass (atrophy) and in size and number of active muscle fibres in individual motor units. Loss of 3 - 5% of total muscle tissue per decade after age of 50. 6) Decrease in # of mito-chondria in muscle cells. 7) Increase in connective tissue (elastic & collagen). 8) Increase in fat infiltration and other non-muscle tissue. 9) Tightening of postural muscles (back, hams, gluts) and weakening of phasic muscles (abs, quads, tibialis). 10) Decrease in bone mass and mineral content. 11) Decrease in bone density and bone diameter. 12) Decrease in synovial fluid production and viscosity.	1) Decrease in following components of fitness due to physiological changes to the musculo-skeletal system: ▪ Muscular endurance ▪ Cardiovascular endurance ▪ Flexibility ▪ Agility ▪ Coordination ▪ Balance ▪ Body Composition (increased percentage fat versus lean tissue) ▪ Power ▪ Muscular Strength ▪ Speed 2) Higher incidence of fractures, especially vertebral, radius and femur.	4) Design exercises in order to improve the following: ▪ Cardiovascular endurance ▪ Flexibility and balance ▪ Agility and Coordination ▪ Body Composition (increased % fat versus lean tissue) ▪ Power and Speed ▪ Muscular Strength and endurance 5) Pay particular attention to improving the strength and endurance capabilities of the postural muscles of the back, legs, abs and the muscles of the pelvic floor. Stretch muscles that are tight and strengthen muscles that are weak. For example: the upper back muscles are generally over stretched and under worked; the pectoral muscles are over worked and under stretched. 6) Build choreography progressively, one change and a time. Participants need time to connect the mind thinking and the body doing in order to assimilate and learn the choreography so that they are successful 7) Use side traveling movements with caution. 8) Provide intensity options and body position options and expect participants to take responsibility to alter the movement to suit their needs. 9) Avoid sudden twisting movements. 10) Encourage proper landing techniques ie. 'toe-ball-heel'; soft knee landing.	1) Aquatic exercise that is carefully designed and delivered to participants who are fully engaged in the experience (involve the mind, body and spirit) will lead to the following improvements: Increase in: ▪ Muscular endurance and tone ▪ Cardiovascular endurance ▪ Flexibility: Range of Motion ▪ Speed of Motion ▪ Ability to stabilize (balance) ▪ Ability to control weight gain ▪ Resistance to hypokinetic disease (osteoporosis, heart disease, obesity) 2) Buoyancy helps to decrease impact and can relieve pain, discomfort and stiffness. 3) Buoyancy decreases joint compression and can increase range of motion. 4) Resistance of water decreases speed of motion thus controlling the tendency to jam (lock) and jar the body. 5) Resistance is multi-direction providing a balanced workout on all planes (anterior, posterior, frontal, sagittal medial...) 6) Opportunity to design a warm up to increase the amount of synovial fluid in the moving joint(s)

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