

Home Modifications for People with Upper Extremity Impairments

Week 1. Impairments, Functional Limitations and Design Goals

j	<p>Welcome to Home Modifications for People with Upper Extremity Impairments. In this course, you will learn how functional limitations in upper body movement can impact a person's ability to function safely, independently, or without difficulty in his/her home. You will also learn about the modifications that can compensate for these limitations. In this week's module, we will discuss the contributions of both person and environment to problems with task performance. On the person side, you will learn about normal upper body function as well as functional deficits due to age-related motor changes, disease and trauma. You will also learn about design goals for reducing environmental demands on upper body mobility that will be the basis for making decisions about home modifications. Next week we will apply these concepts to activities in the home so you can become familiar with the types of modifications that can be made to ameliorate the effects of typical problems with task performance.</p>	
c	<p>Upper Extremity Mobility</p> <p>When we talk about upper extremity mobility, we are referring to body functions, including range of motion, strength, endurance, speed, and/or accuracy, associated with movement in the shoulders, upper arms, forearms, hands, and fingers. Because mobility is a coordinated effort of the bones, joints, and muscles of the upper extremities, impairment in any of these body structures can result in reduced capacity in any of the associated body functions. Reductions in capacity, in turn, can lead to functional limitations in reaching and handling. The latter includes gripping, pulling, pushing, pinching, fingering, turning, pressing and lifting all of which are required for interacting with the home environment to perform routine tasks.</p> <pre> graph LR A[Impairment in Body Structure] --> B[Change in Body Function (reduced ROM, strength, endurance, speed, coordination)] B --> C[Change in Capacity (functional limitations)] C --> D[Performance Deficits] </pre>	

j	<p>Normal Upper Extremity Function</p> <p>Upper extremity movement is the result of the coordination of several areas of the brain, including the motor cortex, cerebellum, and basal ganglia. To understand how movement occurs, it is helpful to consider a typical voluntary movement, such as opening a door. A simple task analysis based on observations suggests that the arm is lifted and extended towards the door. As the hand reaches the door handle or knob, the fingers are opened and wrapped around it in a gripping position. The hand and forearm rotate to turn the knob or handle, and the door is pushed or pulled open.</p> <p>While this simplified task analysis gives us an idea of the functional abilities (e.g., reaching, gripping, pushing/pulling) that are necessary to open a door, it does not identify the complex sensorimotor process that is coordinated in several different areas of the brain and spinal cord. In fact, the voluntary motor command for reaching out to the door handle begins in the motor cortex located on the outer, wrinkled surface of the brain. Movement of the right arm is initiated by the left motor cortex, which produces signals that are sent to the involved muscles. These electrical signals move along upper motor neurons, through the midbrain, to the spinal cord. At the spinal cord, they connect to lower motor neurons, which convey the signals from the spinal cord to the surfaces of the muscles involved. Electrical stimulation of the muscles causes contraction, and the force of contraction pulling on the skeleton causes movement of the arm, hand, and fingers.</p> <p>During this whole process, sensory feedback is provided from the visual, auditory, vestibular, cutaneous, and proprioceptive systems. The sensory system collects information from the external receptors such as the eyes, ears, and skin, and processes it to determine what physical adjustments need to be made. So, not only does the brain have to figure out which muscles to contract, it also has to help guide the hand to the door handle, estimate the force needed to close on the handle, and determine the material the handle is made from.</p> <p>Now that you know how normal upper body movement occurs, let's look at what happens to functioning when the body structures that control movement are impaired.</p>	
c	<p>Impairment and Limitation in Function</p> <p>Functional limitations can be caused by the natural progression of normal aging, a disease/medical condition, or trauma that reduces movement capacity in the upper extremities. Limitations resulting from age-related changes are generally chronic and progressive; whereas limitations due to disease and trauma may either be acute, as a one time occurrence or a relapsing condition; or chronic, as</p>	

a stable or progressive state.

Normal Age-Related Changes. Even though disease, rather than normal aging, usually accounts for loss of function in old age, there are a number of naturally occurring processes that affect ability and are the consequence of aging. With aging, individuals experience impairments in body structures that correlate to decline in body function and result in reduction in a variety of upper extremity abilities. Although all body structures undergo transformation as we age; changes in the skeletal and muscular systems have the biggest impact on upper extremity functioning.

1. Age-Related Changes in the Skeletal System: Bones, Joints and Stature

Changes in Bones. Thinning of bones is associated with menopause and aging in general. As bone material dissolves and is absorbed faster than new bone is made, bones become thinner. Bones also become less dense and more fragile due to a decrease in mineral content.

- Impairment in Structure. Thinning and loss of bone density increase the likelihood of fractures. In addition, as bones lose significant mass, osteoporosis develops, further increasing the possibility of fractures. When thinning bones fracture, movement and weight bearing capability of that body part is limited. The resulting impairment in function may persist for a lengthy period of time or be a permanent condition, as bones take longer to heal and sometimes, do not completely heal, in older individuals.
- Changes in Body Function. Bone fractures can reduce range of motion, accuracy, endurance, speed, and strength in the upper extremities.
- Functional Limitations. Reductions in upper body functions can result in functional limitations in reaching and handling, including reduced ability for gripping, pinching, fingering, pressing, pushing, pulling, turning and lifting.

Changes in Joints. As we age, the water content of tendons decreases as does the elasticity in cartilage and ligaments.

- Impairment in Body Structure. The significant breakdown of tendons, cartilage and ligaments results in stiffer tissues, loss of joint flexibility, and ultimately, inflammation and pain. In general, joints become significantly less tolerant to stress as we age.
- Changes in Body Function. Impaired elasticity produces a decline in average joint mobility in healthy people affecting range of motion. Inflammation of joints and pain associated with and without movement can also cause individuals to curtail activity or be unable to move the associated extremities. Joint changes can make it hard to perform tasks that require strength, range of motion, speed, endurance, and accuracy.
- Functional Limitations. Loss of flexibility results in functional limitations in reaching, lifting, pulling, pushing, fingering, gripping, pinching, and turning.

Changes in Stature. Changes in stature are the result of a history of poor posture and loss of fluid in the intervertebral disks begins.

- Impairment in Body Structure. A history of poor posture can cause curvature of spine which can make the shoulders become narrower. In addition, loss of fluid results in shrinkage of the trunk and reduction in height. As the trunk shrinks, an individual experiences a shorter seated height compared to standing height.
- Changes in Function. Narrowing of the shoulders and shrinkage of the trunk both reduce an individual's range of motion.
- Functional Limitations. Reduced range of motion will result in reaching limitations from both standing (due to narrowing of shoulders) and seated (due to trunk shrinkage) positions.

2. Age-Related Changes in the Muscular System: Muscle Mass, Composition and Activation

Changes in Muscle Mass. As we age, muscle fibers in both the upper and lower extremities begin to shrink. At the same time, muscle tissue is replaced more slowly. These changes affect individuals of both genders and of all races and ethnicity.

- Impairment in Body Structure. Changes in fibers and tissue result in muscle mass declining by about one percent a year from the age of 30 [1]. This impairment, called sarcopenia is one of the major causes of disability in older persons
- Changes in Body Function. Loss of muscle mass leads to a reduction in strength.
- Functional Limitations. Loss of strength in the upper extremities can cause difficulty handling objects, including gripping, fingering, pinching, pushing, pulling, pressing, turning, and lifting.

Changes in Muscle Composition and Activation. The quantity of fast-twitch muscle fibers significantly decreases with age, causing the action potentials of motor neurons to produce slower peak power, lower peak power, and prolonged contractions. At the same time, joint, stimulation thresholds in the muscle and cutaneous receptors begin increase, thus requiring more stimulation prior to a response.

- Impairment in Body Structure. The loss of peak power impairs a person's ability to exert quick and strong bursts of movements. In addition, reaction time is increased due to the increased receptor thresholds.
- Changes in Body Function. Overall, loss of muscle fiber and slower reaction time results in decreases in speed of upper body movement. Additionally, precision and accuracy of movement are impaired, making motion appear less coordinated or jerky as an individual compensates or overcorrects.
- Functional Limitations. Reduction in speed may affect functions that require quickness such as gripping, pulling, pushing, turning and lifting. Reduction in accuracy can result in functional limitations in gripping,

	fingering, pressing, pinching and reaching.	
j	<p>Changes Due to Health Conditions and Trauma.</p> <p>Upper extremity motor impairments can also be caused by congenital issues, the cumulative effects of injuries experienced earlier in life, trauma, degenerative diseases, illnesses, congenital issues and genetic malformations. These causes can be manifest in a number of upper extremity impairments, most notably paralysis, paresis, dyskinesia, and limitations in joint movement.</p> <ul style="list-style-type: none"> • Paralysis. There are four types of paralysis: monoplegia (affecting only one limb), hemiplegia (affecting one side of the body), paraplegia (affecting both legs and the trunk), and tetraplegia (quadriplegia) (affecting all four limbs and the trunk). Paralysis is the complete loss of muscle function in one or more muscle groups caused by loss to the nerve supply. The damage may originate from the brain, spinal cord, or muscle in the form of a tumor, hemorrhage, infection, toxic substance, or injury. Paralysis may be flaccid, in which muscles have little or no tone; or spastic, in which the muscles are tight. Individuals with paralysis may also experience a loss of sensation in the affected area. Strength, range of motion, speed, accuracy, and endurance of voluntary muscle movement will all be impaired. • Paresis. Paresis is a weakness or reduction in muscle power caused by damage, disease, or lesions in the brain, spine, or muscle. The loss of muscle power results in impaired or a partial loss of movement. Like paralysis, there are four types of paresis: monoparesis (one leg or one arm), paraparesis (both legs or both arms), hemiparesis (one arm and one leg on both side of the body), or tetraparesis (quadriparesis) (all four limbs). Paresis reduces strength, speed, accuracy, and endurance. • Dyskinesia. Dyskinesia is impairment in the ability to control movements, characterized by spasmodic or repetitive motions, or lack of coordination. There are several different forms of dyskinesias including chorea, tremor, and athetosis. Chorea presents as irregular, involuntary movements that result in an inability to maintain a sustained contraction, which causes individuals to drop objects or have a dance-like gait. This will affect strength, endurance, accuracy, and speed. Tremor is rhythmic movement that may occur at rest, with action, or when holding a position or posture. Accuracy and speed can be affected with tremors. Athetosis creates movements that are continuous, slow, and writhing, which will impact accuracy, speed, and range of motion. • Joint movement limitations. Limitations in joint movement are due to wearing away, inflammation, contractures, or degenerative disease process of the joints. These problems may cause inflexibility in the joint or pain that primarily inhibits range of motion, although strength, endurance and speed may also be affected. 	

	<p>These upper extremity impairments are associated with a wide range of health conditions, such as arthritis, stroke, Parkinson's Disease (PD), Cerebral Palsy (CP), spinal cord injury (SCI), head injury, loss of limbs, Multiple Sclerosis (MS), Amyotrophic Lateral Sclerosis (ALS) and Muscular Dystrophy (MD). Let's take a look at how some of these conditions affect impairment in body structure, body function, and functional abilities.</p>	
j	<p><u>1. Arthritis.</u> There are over 100 types of arthritis, including osteoarthritis. Arthritis is chronic or degenerative joint inflammation that causes pain, stiffness, and ultimately damage to joint cartilage and surrounding structures.</p> <ul style="list-style-type: none"> • <u>Impairment in Body Structure.</u> Damage to cartilage and surrounding areas can lead to joint weakness, instability and visible deformities that, depending on the location of joint involvement, can interfere with the most basic daily tasks. • <u>Changes in Body Function.</u> Inflammation causes a reduction in tactile sensation and range of movement with a corresponding loss of dexterity and mobility. Individuals with arthritis may or may not be able to use the affected limb or digits at all, or may fatigue quickly. Accuracy and coordination may not be affected, but the individual may not be able to perform these tasks quickly. Individuals with arthritis will have joint movement limitations and may have problems with range of motion, strength, endurance, accuracy, and speed. • <u>Functional Limitations.</u> Activities that place force on the joints, such as lifting, carrying, pushing, and pulling or tasks requiring gripping, pinching, turning, fingering, and pressing can be difficult. <p><u>2. Stroke.</u> Stroke, or Cerebral Vascular Accident (CVA) is the result of: 1) thrombosis- blood clot in a blood vessel blocks blood flow past that point; 2) hemorrhage- bleeding into the brain tissue that is associated with high blood pressure or rupture of an aneurysm; or 3) embolism- a large clot that breaks off and blocks an artery. When any part of the brain doesn't get the oxygen it needs, it begins to die. When a part of the brain dies, the part of the body it controls is affected.</p> <ul style="list-style-type: none"> • <u>Impairment in Body Structure.</u> Among other conditions (such as impaired memory and speech), stroke causes paralysis and paresis. Typically, if a stroke occurs in the right side of the brain, it is possible that the person will experience paralysis on the left side (hemiplegia) of the body, along with vision problems and memory loss. If a stroke occurs on the left side of the brain, it is possible that the person will experience paralysis on the right side of the body, speech and language problems, and memory loss. • <u>Changes in Body Function.</u> Paralysis and paresis can produce problems with upper extremity strength, accuracy, endurance, range of motion, and speed. 	

	<ul style="list-style-type: none"> • <u>Functional Limitations.</u> Paralysis and paresis in upper extremities can result in functional limitations in both reaching and handling, including gripping, fingering, pinching, pushing, pulling, pressing, turning, and lifting. 	
c	<p>3. <u>Parkinson's Disease.</u> PD affects men and women equally and usually develops after the age of 65. PD destroys cells the substantia nigra area at the base of the brain, near the spinal column. Cells in this area of the brain communicate with other parts of the brain by releasing dopamine.</p> <ul style="list-style-type: none"> • <u>Impairment in Body Structure.</u> PD is associated with the destruction of neurons in the substantia nigra. As an increased number cells in the substantia nigra region of the brain die, less dopamine is produced, causing stiffness and slowness in the muscles, resting tremors (a form of dyskinesia), and problems initiating movement. PD is chronic and progressive, typically beginning with symptoms on one side of the body that eventually manifest on both sides. There are treatments that can help manage the symptoms of the disease and make movement easier, but unfortunately, they do not stop the progression of the disease. In some cases, these treatments can also cause associated impairment such as levodopa therapy creating dyskinesia. • <u>Changes in Body Function.</u> PD impacts range of motion, strength, accuracy, endurance, and speed. Initially, the stiffness and slowness of movement is frustrating and can make it mildly difficult to complete tasks. As symptoms become more pronounced, patients may have more significant trouble walking or completing other simple tasks, and have an increased risk of falls. • <u>Functional Limitations.</u> Depending on the progression of PD, the range and degree of functional limitations that are experienced will vary and include problems with reaching and handling (i.e., gripping, fingering, pinching, pushing, pulling, pressing, turning, and lifting). <p>4. <u>Cerebral Palsy.</u> CP is an injury that results from damage to the motor areas of the brain prior to brain maturity (most cases of CP occur before, during, or shortly following birth). CP can be classified into four groups depending on associated movement patterns: spastic, athetoid, ataxic, and mixed (having any combination of the other three types).</p> <ul style="list-style-type: none"> • <u>Impairment in Body Structure.</u> The brain damage causes problems with muscle tone control that impairs upper extremity movement and presents as dyskinesia. In addition, CP is associated with a number of other impairments, such as seizures, abnormal sensation and perception, visual and hearing impairments, and speech impairments. Although cognitive impairment is present in some people with CP, the majority function with normal or above normal intelligence. • <u>Changes in Body Function.</u> Function can be affected in various ways depending on the type of CP. Spastic CP results in jerky movements that are stiff and frequently imprecise. Different body parts can be affected 	

	<p>by spastic CP, including both legs (spastic diplegia), one side of the body (spastic hemiplegia), and all body parts (spastic quadriplegia). In spastic CP, accuracy, speed, strength, and endurance of movement are reduced. Athetoid CP causes slow, involuntary, and uncontrolled movements, consequently impacting accuracy, speed, and range of motion. Ataxic CP creates difficulty with balance and coordination, making it difficult to move speed or accuracy.</p> <ul style="list-style-type: none"> • <u>Functional Limitations.</u> Functional limitations associated with CP can vary depending on the type of CP, as well as the affected body parts. Individuals with CP may experience difficulty with both reaching and handling, including gripping, fingering, pinching, pushing, pulling, pressing, turning, and lifting. 	
j	<p><u>5. Spinal Cord Injury.</u> The spinal cord is a bundle of nerves consisting of upper motor neurons, that carry messages back and forth from the brain, and lower motor neurons that extend to other parts of the body. The main part of the spinal cord is divided into seven cervical, 12 thoracic, and five lumbar vertebrae. Spinal Cord Injury (SCI) is caused by damage to the spinal cord due to trauma (e.g., car accident) or disease (e.g., Polio) and is categorized according to the vertebral location (e.g., C6) and whether it is a complete or incomplete injury.</p> <ul style="list-style-type: none"> • <u>Impairment in Body Structure.</u> A complete injury means that there is no sensation and no voluntary movement below the level of the injury on both sides of the body. An incomplete injury corresponds to some functioning below the primary level of the injury, possible sensation in body parts that cannot be moved, and potentially more function on one side of the body than the other. SCI can result in tetraplegia or paraplegia, depending on the location of the injury on the spine and the type of damage to the cord. Individuals with tetraplegia (or quadriplegia) typically experience paralysis, paresis, and loss of sensation and proprioception in all four extremities. Breathing, moving the head and neck, talking, and swallowing can also be affected. Individuals with paraplegia typically experience paralysis, paresis, and loss of sensation and proprioception in their legs. • <u>Changes in Body Function.</u> Both tetraplegia and paraplegia can affect strength, range of motion, endurance, speed, and accuracy of movement. Individuals with tetraplegia use wheelchairs (power and manual) and, depending on the severity of their injury, may or may not be able to use their arms, hands, or fingers. Individuals with paraplegia may use a wheelchair, a walker, crutches, a cane, or braces for mobility. An individual with paraplegia may or may not be able to independently perform most activities involving arm, hand, finger, trunk, or leg movement. • <u>Functional Limitations.</u> Functional limitations associated with para- or tetraplegia can vary depending on the type of SCI, as well as the affected body parts. Individuals with SCI may experience difficulty with 	

	<p>reaching and all handling (i.e., lifting, lowering, carrying, reaching, fingering, gripping, pulling, pushing, pressing, pinching, and turning) functions.</p> <p>6. <u>Head injury</u>. Head injuries are caused by concussions, cerebral hemorrhages, brain stem injuries, closed head injuries, skull fractures, foreign objects (e.g., bullet), anoxia, and post-operative infections.</p> <ul style="list-style-type: none"> • <u>Impairment in Body Structure</u>. Head injuries can result in paralysis, paresis (on one side of the body or both) and/or dyskinesia, along with a range of other speech/language, sensory, cognitive, and behavioral impairments. • <u>Changes in Body Function</u>. Depending on the etiology of the head injury, various body parts and functions will be impaired due to paralysis or paresis. Paralysis will affect strength, range of motion, speed, accuracy, and endurance of voluntary muscle movement. Paresis will reduce strength, speed, accuracy, and endurance. • <u>Functional Limitations</u>. Depending on the extent of paralysis or paresis, head injured individuals may experience difficulty with reaching and handling (i.e., gripping, fingering, pinching, pushing, pulling, pressing, turning, and lifting). <p>7. <u>Absence or Loss of Limbs or Digits</u>. Trauma (e.g., explosions, mangle in a machine, severance, burns), surgery (due to cancer, peripheral arterial disease, diabetes), and genetic malformations (e.g., dwarfism) can lead to an absence or loss of limbs or digits in the upper extremities. Individuals without limbs or digits may or may not use a prosthesis. Even with a prosthesis, they may have difficulty performing activities requiring use of their arms, hands, or fingers.</p> <ul style="list-style-type: none"> • <u>Impairment in Body Structure</u>. Depending on which limb and the extent of limb or digits are missing, impairment may be mild or severe. A prosthesis can improve functionality, but may not provide comparable ability. • <u>Changes in Body Function</u>. Absence of limbs or digits can impact range of motion, strength, accuracy, and speed. • <u>Functional Limitations</u>. Depending on which limbs or digits are missing, an individual experience difficulties with reaching, gripping, fingering, pinching, pushing, pulling, pressing, turning, and lifting.. 	
c	<p>8. <u>Multiple Sclerosis</u>. Multiple Sclerosis (MS) Multiple sclerosis is a progressive neuromuscular disease in which the myelin covering of nerve fibers in the brain and spinal column deteriorates. People with MS can expect one of four clinical courses of disease, each of which might be mild, moderate, or severe: relapsing-remitting (symptoms appear and then remit), primary-progressive (slow, but nearly continuous worsening of their disease from the onset, with no distinct relapses or remissions), secondary-progressive (an initial period of relapsing-remitting disease, followed by a steadily worsening disease course), progressive-relapsing (a steadily worsening disease from the onset, but with acute relapses).</p>	

- Impairment in Body Structure. Once the myelin is damaged, it is replaced with scar tissue which blocks and distorts messages from the brain.
- Changes in Body Function. People with MS may experience weakness, paresis, loss of coordination, paralysis, and dyskinesia (e.g., tremors and spasticity) in the upper extremities. These symptoms will effect reduced strength, accuracy, endurance, speed, and range of motion.
- Functional Limitations. Since MS directly affects the nervous and muscular systems, there is potential for the full range of upper extremity functioning to be affected, including, reaching, gripping, fingering, pinching, pushing, pulling, pressing, turning, and lifting.

9. Amyotrophic Lateral Sclerosis. ALS or Lou Gehrig's Disease is a degenerative disease of the central nervous system. In this disease process, the upper motor neurons and lower motor neurons degenerate or die, making it impossible for the brain and muscles to communicate. A

- Impairment in Body Structure. ALS is characterized by slowly progressive paralysis of the voluntary muscles. LS symptoms may develop with either bulbar onset (affects the muscles in the face, mouth, and throat), limb onset (affects the extremities and torso first, then develops bulbar symptoms), or both.
- Changes in Body Function. Individuals with bulbar onset present with difficulty in speaking and swallowing, which are debilitating, but do not affect upper extremity function. Limb onset does affect upper extremity function and begins with fatigue or a general weakness of one or more legs, arms, and hands. Eventually, limb onset cases will develop bulbar symptoms. Although symptoms and the order in which they manifest themselves will vary for each individual, the eventual outcome is overall muscle weakness and paralysis leading to problems with strength, speed, endurance, range of motion, and accuracy.
- Functional Limitations. The related functional limitations are dependent upon the type of onset, progression, and stage of the disease. Eventually all upper extremity abilities will be affected including reaching, gripping, fingering, pinching, pushing, pulling, pressing, turning, and lifting.

10. Muscular Dystrophy. MD is a group of hereditary genetic disorders that prevent the body from making the proteins it requires to build and maintain muscles. There are nine major types of MD including myotonic, Duchenne, Becker, limb-girdle, facioscapulohumeral, congenital, oculopharyngeal, distal, and Emery-Dreifuss. Most types of MD are life-threatening; however, some types progress slowly and do not cause death.

- Impairment in Body Structure. Muscular dystrophy is characterized by progressive muscular weakness (paresis) and wasting, loss of muscular control, and muscle contractions. According to the type of MD, individuals may have difficulty using their upper and lower extremities, facial muscles, and respiratory muscles. In some cases, MD can affect the heart, cognition, vision, and swallowing.
- Changes in Body Function. All types of MD, except for oculopharyngeal,

	<p>can affect upper extremity function. With the muscle weakness and wasting in these forms of MD, individuals will experience a gradual decline in upper body range of motion, strength, accuracy, speed, and endurance.</p> <ul style="list-style-type: none"> • <u>Functional Limitations</u>. Almost all types of MD will affect performance in reaching, gripping, fingering, pinching, pushing, pulling, pressing, turning, and lifting. 	
j	<p>Design Goals for Home Modifications</p> <p>So far we've emphasized the person side of the equation; that is, how impairments can limit body functioning and how body functions can limit abilities. Now we are going to introduce you to the environment side of the equation through a set of design goals. These goals, in conjunction with the information we've already covered, will help you make decisions about what to change and what to look for in making changes in one's home. As you'll see next week, these design goals are applied in different ways based on the tasks with which individuals are having performance difficulties.</p>	
j	<p>The first design goal is to minimize reaching. As we have seen earlier in this lecture, upper mobility impairments typically affect upper/lower, lateral, and forward reach. This means that where objects are located in relation to the body directly impacts whether it can be reached and/or used. Therefore, objects located below the torso, such as outlets on walls (Figure 1); overhead, such as pull chains on lights (Figure 2); or out in front, such as sink faucets and items on counters (Figures 3 and 4); will potentially cause difficulty in task performance. Since reaching an object is relative to an individual's position in space and his/her reaching ability, changing object location to bring it closer to the user is an approach that can minimize performance difficulties. Reducing object distance can be accomplished by changing object height and/or its placement. To minimize upward or lower reach, objects can be moved to a higher or lower level in the vertical plane, such as raising an outlet on a wall or storing frequently used items on a shelf below the medicine cabinet. Similarly, to minimize forward reach, objects can be brought closer, such as moving a faucet from the centerline of the tub to the outside edge or by using pull out shelves in cabinets.</p> <p>The figs below are placeholders (need to not all be WC users)</p>	

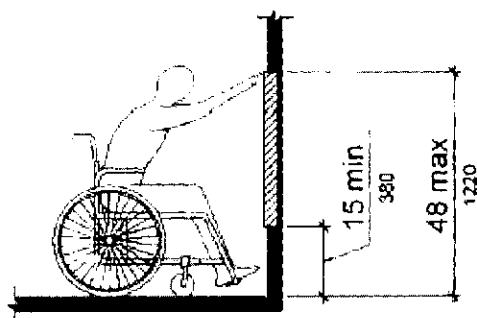


Figure 1. Upper and Lower Reach

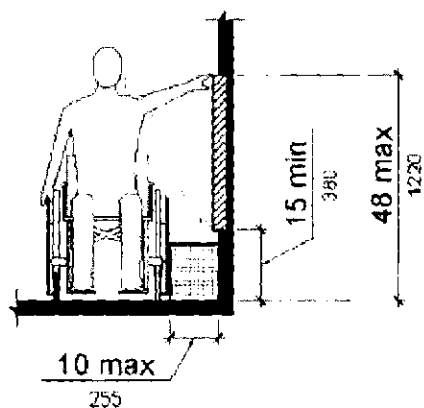


Figure 2. Side Reach

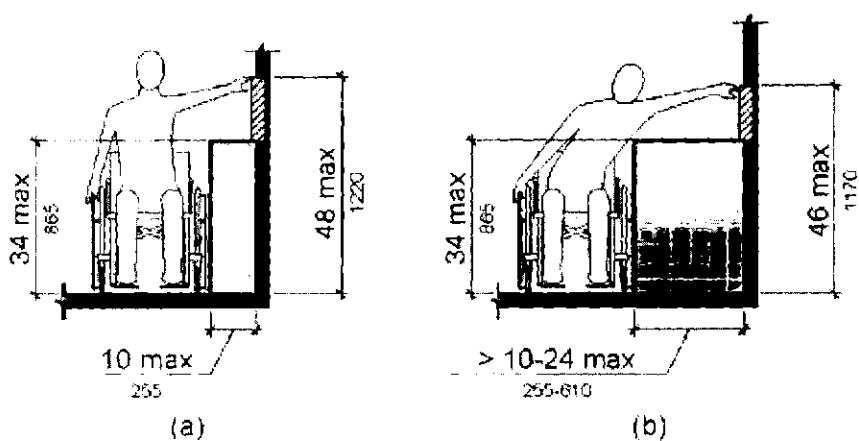


Figure 3. Side Reach Over an Obstruction

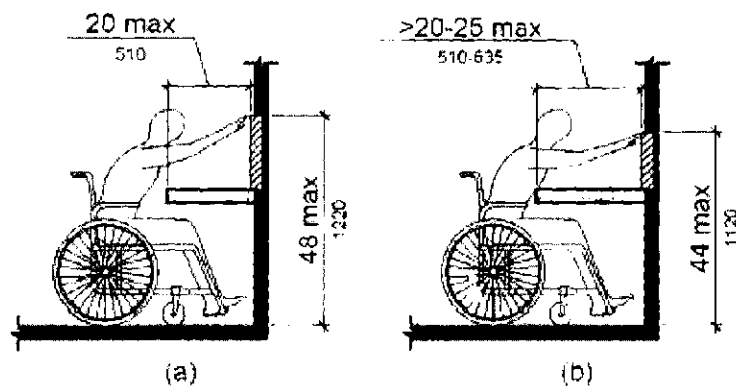


Figure 4. Forward Reach Over an Obstruction

- c Next, you want to **facilitate handling**. When we refer to handling, we are really talking about all types of object manipulation, including gripping, pinching, fingering, pressing, pushing, pulling, turning, and lifting. Since our hands are the primary means for us to manipulate the physical environment, impairments that limit fine motor control and dexterity can severely limit our ability to perform almost all household tasks including opening a door, turning on a water faucet, going up and down stairs, holding a glass, and writing a letter. Like reaching, handling is dependent on the interaction between an individual's ability and the characteristics of the object. The sizes and shape of an object can make it hard to hold or use. Smaller and rounder shapes require more dexterity, whereas larger shapes with angles are typically easier to use. Similarly, texture and material can facilitate or hinder use. A counter with a rough surface may make it difficult to slide and object across, yet a smooth grab bar may be difficult to maintain a firm grasp. As a result, **changing object attributes** (e.g., size, shape, texture, and surface material) to capitalize on an individual's remaining abilities, minimize sustained effort or replace repetitive/multiple manipulations (e.g, gripping and turning) with single actions (e.g., pressing or pushing), is a potentially effective approach to facilitate object handling. For example, to facilitate opening a door, the door knob, which requires multiple actions of gripping and turning, can be replaced with a lever handle that can be pushed with a either a closed fist or open hand. Similarly, railings or grab bars should have a size and shape that accommodate an individual's hand size and handling abilities. To facilitate use of everyday household implements, there is a wide range of tools with soft grip and molded handles. Additionally, a variety of assistive aids are available to adapt writing implements, eating utensils, control knobs and other objects so that they are easier for an individual to use.

j	<p>If minimizing reaching and facilitating handling are not effective design goals, you can consider eliminating reaching and handling altogether. This goal is particularly important when an individual is unable to reach or handle an object, or these functions are too difficult to perform no matter how much the location or attributes of the object are changed. For example, an individual without the strength and dexterity to operate a lever faucet handle will not benefit from either relocation or changing the attributes of faucet handles. Similarly, an individual without the ability to reach a grab bar adjacent to a toilet will not benefit from bars that are an appropriate size and shape. In these cases, <i>using alternative or automatic systems</i> to maximize an individual's (and/or caregiver's) other functional abilities is an effective modification strategy. As a result, this strategy typically substitutes one ability for another by changing the way a task is performed. For example, using a remote controlled lock instead of a key operated lock substitutes pressing a button for fingering and turning. In contrast, using a motion activated light replaces an inability to reach, finger, or press with an ability to ambulate or propel a wheelchair.</p>	
j	<p>Now that you have a basic understanding of the goals, you are ready for next week's lecture where you will learn how to apply these design goals to typical problems with task performance in order to develop home modification solutions</p>	
	<p>Stats/Tidbits for Sidebars</p> <p>About 1 in 10 adults aged 55 years and over have difficulty reaching (10.9%) or grasping (9.4%) with rates tripling between the ages of 55–64 years and 85 years and over.</p> <p>Overall, 15.0% of adults aged 55 years and over had difficulty carrying 10 pounds and rates increased with age. About 11% of adults 55–64 years had difficulty carrying 10 pounds compared with 38.5% of adults aged 85 years and over (Figure 2). + About one in five adults aged 55 years and over (20.5%) had difficulty pushing or pulling large objects, with rates for those aged 85 years and over (46.6%) triple those of adults aged 55–64 years (15.5%).</p> <p>For each of these activities, respondents were asked if, by themselves and without the use of special equipment, the activity was "not at all difficult," "only a little difficult," "somewhat difficult," "very difficult," "can't do at all," or "do not do this activity." The estimates shown include responses of "somewhat difficult," "very difficult," or "cannot do at all." Adults who said "do not do this activity" were excluded from the analysis.</p> <p>Schoenborn CA, Vickerie JL, Powell-Griner E. Health characteristics of adults 55 years of age and over: United States, 2000–2003. Advance data from vital and health statistics; no 370. Hyattsville, MD: National Center for Health Statistics. 2006.</p>	

	<p>References</p> <ol style="list-style-type: none">1. Tufts University. <i>Refining the Exercise Prescription to Maintain Muscle Power as We Age</i>. 2006 [cited 2006 August 1, 2006]; Available from: http://www.tufts.edu/central/research/ResearchNews/Researchers/Fielding.html.2. Garg, A., <i>Ergonomics and the older worker: An overview</i>. Experimental Aging Research, 1991. 17(3): p. 143-155.	

HOME MODIFICATIONS FOR PEOPLE WITH UPPER EXTREMITY IMPAIRMENTS

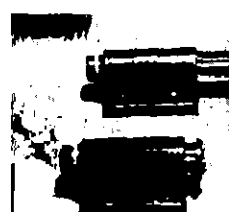
Week 2: Problems and Solutions

j	Introduction In week one you learned about upper extremity impairment and how its can reduce a person's ability to function safely, independently and easily in his/her home. You also learned about the ways in which design goals can help you make decisions about home modifications. This week we will apply these concepts so you will become familiar with the specific problems that people with upper extremity impairment and their caregivers experience in the home and the types of modifications that can be made to ameliorate the effects of these problems.	
c	Problems experienced by people with upper extremity impairment Home modifications for people with upper extremity impairment are a little different than those for people with other types of impairments. First, people with upper extremity impairment experience problems with various routine activities in the home, such as getting in and out of the home, getting around, or getting on and off the toilet. However, the specific difficulties they experience are somewhat different than those experienced by people with lower extremity motor or sensory impairments because they involve the body structures that physically interact with physical environment. In other words, unlike sensory impairments that affect receiving stimuli from the environment and lower extremity impairments that primarily limit access to places and spaces, upper extremity impairment limits an individual's ability to use and manipulate objects, many of which are used to control the home environment. As a result, many of the home modification solutions are different than those used for people with other types of impairments as they primarily minimize reaching and facilitate handling.	
j	Difficulty and Dependence Home modifications for people with upper extremity impairment are made for one of two reasons, either to reduce difficulty and maintain the independence of the individual or to enhance the ability of a caregiver to provide assistance. People with chronic conditions that are stable are generally capable of maintaining independence and performing routine activities independently. As a result, home modifications for these individuals primarily focus on reducing demands on upper extremity abilities to reduce task difficulty and to maintain independence and safety. However, over time, individuals with progressive conditions, such as arthritis, MS, and Parkinson's are generally less able to do	

	things for themselves. As a result, home modifications for these individuals primarily focus on reducing environmental demands to facilitate caregiving and assistance.	
j	Home Modifications for Problems Related to Upper Extremity Impairment Now that we have described the rationale for selecting different types of modifications, you are ready to learn about the specific types of problems experienced by people with upper extremity impairments in the home that can be addressed by home modifications and the modifications that will address the problems.	
c	I think your first point is an important one to reiterate. This is a course on home modifications. Therefore, we want to cover problems for which modifications can be effective solutions. Remember our definition of home modifications? They are changes to the physical environment of the home. There are lots of problems that people with upper extremity impairments may have that will not be directly affected by changing the physical environment. This is not to say that they cannot be addressed at all, just that they cannot be effectively addressed by home modifications. Therefore, we will not be covering those things in this course.	
j	Right, Carrie. Conversely, we also do not believe that home modifications alone are the solution to all of the problems that we will cover in this course. Changes to the environment can only create opportunities for autonomy and supervision. The effectiveness of the modifications in supporting either of these goals will depend on the situation. This means that home modifications should provide an environment that is supportive of the needs of a person with upper extremity impairments, his/her caregiver(s), and any other therapeutic changes that might be needed. Home modifications therefore, are a part of a larger set of situationally-directed solutions. They are not, in and of themselves, the solution.	
c	It is important to be able to see the connection between upper extremity impairment and problems that people with these impairments can experience in the home. It is also important for you to understand the connection between these problems and the design goals that we told about last week so you will see how the design goals drive selection of appropriate modifications for each problem area. This way, you will all have a better understanding of what the modifications are intended to do and why certain modifications are recommended.	
j	To do this we have created a really useful table for you. If you look at the link below, there is a .pdf document that you can download. The file includes a table of problems in the home that are associated with upper body impairments as well as their underlying causes. It also includes the design goals and objectives and the modifications that can address these problems based on the design goals.	INSERT LINK TO Mod TABLE HERE

	<p>We should tell you that this table is pretty comprehensive. It includes all the upper extremity-related problems that we could think of, so it should be helpful to take out in the field with you to use as a cheat sheet. However, we don't want you to think that this list contains all the modifications in the universe, because that would be a lifelong project. In addition, no matter how much we know about home modifications, someone is always coming up with a good new idea or creative variation on an old one to solve a problem. Therefore, if you have any new ideas, send them in because we want to add them to the list.</p>	
c	<p>Right, so let's look at the table. If you look at the table you will see the problems (in red) and underlying causes of the problems are listed along the left hand column. For each problem, there are a number of specific objectives (in blue) based on the design goals (in black). These appear in the second column on the table. The last column represents the types of modifications (in green) that will meet the design goals.</p> <p>Now, let's get to what everyone has been waiting for – the modifications!</p>	Show parts of the table- maybe with roll-over balloon explanations of each column.
j	<p>Problems Associated with Routine Activities in the Home.</p> <p>As we said earlier, people with upper extremity impairments have the same general types of problems with routine activities that people with other types of impairments experience. However, because of their impairments, the specific problems are different. There are 5 major activity areas with which people with upper extremity impairments have problems:</p> <ul style="list-style-type: none"> ○ mobility/transfer (e.g., getting in/out of the home, getting around the home, transfer on/off furniture) ○ personal hygiene (e.g., toileting, bathing, grooming, dressing) ○ household activities and chores (e.g., doing laundry, cleaning, managing finances) ○ control of ambient conditions in the home (e.g., regulating temperature and light, operating windows) ○ communication and response (e.g., using a television and a telephone) <p>Within each of these areas there are specific problems caused by upper extremity impairments. Each problem has its own set of design goals and objectives. In turn, each objective has a number of modifications. We will organize these modifications by problem area.</p>	
c	<p><u>Problems with mobility and transfer</u></p> <p>There are three basic categories of <u>mobility and transfer problems</u> that people with upper extremity impairments experience: getting in and out of the home; getting around the home; and transferring into/out of furniture and bed.</p>	NEED Photos of different mods to break up text. This suggestion is for remainder of text.

	<p>Mobility problems related to getting in and out of the home as well as getting around the house are caused decreased range of motion, strength, speed, and coordination, which are manifest in difficulties using handrails to climb stairs or ramps, operating door handles, and using keys. To address these problems, design goals and home modification strategies include: 1) changing the attributes of gripping surfaces (e.g., handrails, door handles and keys) by altering size, shape and texture to facilitate gripping, pushing and pulling and eliminate pinching and turning; 2) changing the location of gripping surfaces (particularly handrails) by installing handrails at a convenient height on both sides of a stair to minimize reaching; and 3) using alternative or automatic opening systems by installing electric or remote control locks, door handles or keypads that eliminate reaching and handling.</p> <p>Problems with transfers include getting in and out of bed or other furniture, on and off the toilet, and in and out of a tub or shower. The latter two will be discussed in the next section – personal hygiene -- so we will focus on furniture transfers here. Transferring on and off of furniture is difficult due to decreased range of motion, strength, and coordination. To ensure safety and maintain independence you should change the location of transfer supports such as the location of chair arms or use floor to ceiling poles (e.g., Superpole), or sturdy furniture adjacent to a bed or chair. If an individual also has significant lower extremity impairment, you might want to use alternative or automatic standing systems that eliminate the need for reaching and handling, such as lift cushion, lift chair or free-standing lift system someone from transferring on their own or install a lift system to increase safety.</p>	<p>Show this part of the table- maybe with roll-over balloon</p>
j	<p><u>Problems with Personal Hygiene</u></p> <p>Now let's go onto the second major problem area, <u>personal hygiene</u>. This area includes toileting, bathing, grooming, and dressing. Problems with toileting are complex because they are not only associated with upper extremity impairments, but also dementia and impairments in vision loss and lower extremities. As a result, many of the same modifications will be used to ensure safety and maintain independence, albeit with different design goals and objectives in mind. First, changing the attributes of gripping surfaces (i.e., grab bars and flush controls) entails altering the size, shape and texture of devices to facilitate gripping, pushing, pulling and pressing. Second, changing location of gripping surfaces (i.e., grab bars) and manipulated objects (e.g., toilet paper) necessitates locating grab bars and toilet paper closer to the user to minimize reaching. This can be accomplished by changing mounting height (such as raising a toilet paper holder) or location (such as placing cantilevered grab bars on the rear wall where they can be closer to the toilet). Finally, using alternative or automatic standing, cleansing or flushing systems to eliminate reaching and handling can be accomplished through installation of lift systems, hands-free cleansing systems and automatic flushing systems, respectively.</p>	<p>Show this part of the table- maybe with roll-over balloon</p>

	Let me give you an example of the types of modifications that were made to enable XXX transfer onto the toilet.	
	Case Study of XXX	
	<p>Email exercise</p> <p>Exercise: There are lots of internet sites that offer recommendations for home modifications for people with dementia. find at least 3 sites that have modifications for people with dementia what modifications would you have recommended forinez based on the information in these sites?</p>	
	<p>Like toileting, bathing is a multi-causal personal hygiene problem that is due to decreased range of motion, strength, and coordination. Similarly, modifications to assist bathing include: changing the attributes of gripping surfaces (i.e., grab bars and faucet controls) entails altering the size, shape and texture of devices to facilitate gripping, pushing, pulling and pressing. Changing the location of gripping surfaces (i.e., grab bars and faucet handles) and manipulated objects (e.g., hand held shower, shampoo, soap) involves locating grab bars and bathing accessories closer to the user to minimize reaching. This can be accomplished by changing mounting height (such as installing two parallel grab bars on the side wall inside the fixture to facilitate getting in/out and lowering/raising) and location (such as placing a vertical grab bar and faucet handle close to the outside wall of the fixture). Finally, using alternative or automatic transfer, or soap dispensing systems to eliminate reaching and handling can be accomplished through installation of lift systems, hands-free soap dispensers, respectively.</p>	Show this part of the table- maybe with roll-over balloon
c	<p>Problems with grooming are caused by decreased range of motion, strength, and coordination. Specific problems include difficulty reaching and gripping faucet handles and accessing items in storage spaces. To address these problems, design goals and modification strategies include changing attributes (i.e., shape) of gripping surfaces (e.g., faucet handles and door/drawer hardware) by adding adaptive devices, installing lever handles and installing easy to open magnetic touch catches (which turn the face of a cabinet door into a pressing surface); changing locations of handles (e.g., moved to the outer edge of the sink), counters/sinks (e.g., lowered to enable use from a seated position) and storage items (e.g., raise or lower shelves, use pull out drawers and relocate items to lower shelves or counter); and using alternative or automatic grooming systems, such as an electric razor and wall-mounted dryer to eliminate gripping, turning, fingering, pressing, pulling, and pushing.</p> <p>Problems dressing, like grooming, are caused by decreased range of motion,</p>	<p>Show this part of the table- maybe with roll-over balloon</p>  <p>Magnetic touch catches</p>

	<p>strength, and coordination. Changing attributes (e.g., size and shape) of door/drawer handles to facilitate gripping and pulling can be accomplished by using adaptive door handles, lever or loop handles and easy to open latches such as magnetic touch latches. Changing placement (height) of storage to minimize reaching can be accomplished by lowering shelves and closet rods and relocating clothing to lower shelves or drawers. Finally, using alternative or automatic opening or clothing storage systems, such as a list of activities, as well as limiting alternatives, such as installing a revolving clothing storage system or installing a storage system with full extension drawers can eliminate reaching and handling.</p>	<p>Show this part of the table- maybe with roll-over balloon</p> <p>Show this part of the table- maybe with roll-over balloon</p>
	<p>Case Study of XXX</p> <p>When we first met Maria, she had lost the ability to know what the first steps were too many of the tasks that she had been doing for years. After a couple of months she lost the ability to sequence tasks even after her daughter, Dorothy got her started. Maria was still able to complete tasks by herself, when there was someone to remind her what to do. So Dorothy started leaving notes for her that listed the order in which to complete certain activities. This worked pretty well for many activities, including bathing where Dorothy had hung a laminated list that reminded her mother to turn on the water, use the shampoo and soap, and rinse off, in that order. She also labeled the hot and cold water on the faucet and hung the soap and shampoo where they were easy to see and reach.</p> <p>Then about a year later, Maria started having problems lifting her legs and walking. As a result, she couldn't step over the side of the tub to take a bath. At first, Dorothy would help her mother get into the tub, but that was beginning to strain her back, so she went onto the internet and found a website that had some good solutions for these kinds of problems. As a result, Dorothy had a local handyman install some grab bars on the outside of the tub to help her mother step into the tub and some on the inside to help her lower herself down.</p> <p>This worked for about a year, but eventually Maria was no longer able to step into the tub. At this point Dorothy bought a tub transfer bench that her mother could sit on outside the tub and use to slide into the tub. She still wasn't able to get to the bottom of the tub to take a real bath, so Dorothy purchased a hand held shower wand that her mother could use while sitting on the tub bench. She also moved the list of tasks, as well as the soap, shampoo and other items closer to the tub bench. This arrangement is still working pretty well for Maria.</p>	
	<p>Cyberclass</p> <p>In the case study of Maria we only covered some of the problems she had with</p>	

	<p>bathing. Knowing what you do about Maria, can you think of some of the other problems she might have had with bathing, grooming, or dressing? What modifications would you suggest to Dorothy to help with those problems?</p>	
c	<p><u>Problems with Household Activities and Chores</u></p> <p>The next problem area is household activities and chores. This includes things like preparing meals/eating, doing laundry, cleaning/organizing, maintaining the home, and managing financing.</p>	
	<p>Preparing meals and eating is the first set of issues we will address. And remember, there are many more modifications on the table than what we're going to cover here. Like grooming and dressing, difficulty in eating and meal preparation is created by decreased range of motion, strength, and coordination. Therefore design approaches include: changing location (e.g., height and placement) of stored items and appliances to minimize reaching; using alternative or automatic storage systems to eliminate handling and reaching and changing attributes of handles and transport surfaces to facilitate handling and minimize lifting. Modifications to change location of storage and appliances include: placing frequently used items at the front of cabinets or on shelves that are at a convenient; raising dishwasher, lowering wall oven and microwave, and using side-by-side or bottom-freezer refrigerators. Alternative or automatic storage systems are modifications such as installing lazy susans, pull-out shelves and full extension drawers in cabinets, using a refrigerator with sliding shelves, and replacing counters and cabinets with motorized or manually-operated models that raise and lower. Finally, changing attributes of handles and transports involve using adaptive appliance control handles, replacing appliances with ones that have push button controls, installing loop handles on cabinet drawers and doors, changing faucet controls to lever handles, creating smooth surfaces on countertops for easy sliding of objects and providing mobile storage units (e.g., rolling cart) to transport objects.</p> <p>Next, is doing laundry. Unlike all of the other problems we have talked about thus far, doing laundry does not always take place in a specified room. In fact, it is often relegated to a closet or it is allocated space in the family room or kitchen. As a result, it is difficult to anticipate all of the problems that an individual might have. With that in mind, we will presume that someone has "a laundry" that is at least the equivalent of a walk/roll-in closet.</p> <p>Doing laundry creates many of the same problems as eating and meal preparation since appliances, counter and cabinets are basically the same heights and types of designs. Therefore, many of the same solutions will be used here. As a result, changing the location (i.e., height) of the washer and dryer by using front loading appliances (i.e., changing the height of the door) raised 6" – 8" off</p>	<p>Show this part of the table- maybe with roll-over balloon</p> <p>Show this part of the table- maybe with roll-over balloon</p> <p>Show this part of the table- maybe with roll-over balloon</p>

	<p>the floor will minimize reaching. Similarly, placing detergents and supplies on lower shelves and lowering storage shelves will bring necessary items closer to the individuals and minimize reaching. If there is sufficient room in the laundry area, using alternative or automatic storage systems, installing pull-out shelves, full extension drawers, pull-out shelves and adjustable height cabinets and counters will eliminate the need for reaching. If an individual's gripping and lifting abilities are compromised, changing the attributes of gripping and transport surfaces can facilitate handling objects. For example, using adaptive appliance controls, replacing appliances with models that have push button controls, and using lever or loop handles on doors and drawers will facilitate or eliminate the need to grasp and turn knobs and handles. To facilitate or eliminate handling and lifting items, counters should have smooth surfaces to push objects across, pull out shelves can be installed adjacent to and at the door height of appliances to serve as transport surfaces, and finally transfer of items to and from the laundry can be facilitated by using a rolling cart and even installing a laundry chute from a floor above.</p> <p>Although there aren't many <u>home</u> modifications to facilitate cleaning, organizing and maintaining a home or for managing finances for people with upper extremity impairments, there are a few that are worth mentioning. The primary problem with both of these activities is difficulty gripping. For both activities, the simplest solution is to change the attributes of gripping surfaces on cleaning or writing implements. There are not only a variety of adaptive handles that can be used on existing implements, but there are a wide range of readily available, ergonomically designed products that have soft handles that facilitate gripping. In addition, using alternative systems to transport cleaning materials, such as a rolling cart and automatic systems, such as a robotic vacuum for cleaning or a computer for managing finances will eliminate reaching, gripping, turning and lifting.</p>	
j	<p><u>Problems with Controlling Ambient Conditions</u></p> <p>The next problem area that we will cover is controlling ambient conditions in the home.</p> <p>Ambient, by the way, is just a fancy name for things like the temperature and light and noise levels in the home. Problems in this area generally related to difficulty decreased range of motion and coordination that cause difficulty operating controls.</p> <p>For people with central heat and/or air conditioning, modifications to facilitate gripping, turning, and pressing controls to regulate indoor temperature include changing the attributes of gripping surfaces by replacing a thermostat with one that has a large dial or large push buttons. For individuals without central systems, using adaptive handles on unit (e.g., window air conditioner) control</p>	<p>Show this part of the table- maybe with roll-over balloon</p>

	<p>knobs or adding a knob on a ceiling fan pull chains can facilitate handling. It may also be possible to change the location of controls to minimize reaching, such as lowering a thermostat on a wall or relocating it to a wall that is clear of furniture or other obstacles. Alternatively, using an alternative or automatic control system such as a programmable or voice activated thermostat or a ceiling fan with a remote control will eliminate reaching and handling problems.</p> <p>Regulating light is also related to operating controls. Changing the attributes of controls to facilitate handling can be accomplished by using large rocker switches rather than small toggle switches or adding a knob to the end of a pull chain light. In addition, changing the location of controls by installing a switch extender rod or lower the switch will minimize reaching. Finally, using alternative or automated systems such as timers and motion sensors on lights and lamps will eliminate reaching and handling altogether.</p> <p>Operating windows, particularly traditional, double hung windows, is difficult for a variety of reasons. However, lack of strength to push the window upward and decreased range of motion to reach upward are the most obvious. To overcome these problems, changing the attributes and location of control gripping surfaces can be accomplished by adapting windows with crank handles or installing casement window with large crank handles.</p>	
	<u>Problems with Communication</u>	
c	<p>The last problem we will cover is communication. In this area will cover modifications that facilitate using the telephone. Often times, lack of coordination makes it difficult to use small buttons on a phone. As a result, changing button attributes by using a large button phone will provide larger targets that are easier to press. Other times, phones are located too high up on a wall or counter, or are on a table that is too far to reach. Changing the location of the phone to a lower or unobstructed location will minimize reach. Of course the easiest solution is to use a remote phone that can be carried on the individual. Finally, using alternative or automatic activation communication systems such as a programmable or voice-activated cell or land-line speaker phone will eliminate reaching or handling altogether.</p>	Show this part of the table- maybe with roll-over balloon
	<p>Cyberclass</p> <p>Can you suggest other modifications that Mrs. Tim could make to prevent Tim from exiting the house or yard?</p>	
j	<p>Summary of key points</p> <p>That wraps up the course. But before we let you go, let's go over some of the</p>	

	<p>key points.</p> <ul style="list-style-type: none"> • People with upper extremity impairments typically have difficulty with task performance due to decreased range of motion, strength, endurance, speed and accuracy/coordination • There are 3 major design goals for home modifications: minimize reaching, facilitate handling and eliminate reaching and handling. These can be accomplished by changing object location, changing object attributes and using alternative or automatic systems, respectively. • There are 5 major problems areas associated with routine activities in the home: <ul style="list-style-type: none"> ○ mobility/transfer (e.g., ambulating and getting up and down) ○ personal hygiene (e.g., toileting, bathing, grooming, dressing) ○ household activities and chores (e.g., doing laundry, cleaning, managing finances) ○ control of ambient conditions in the home (e.g., using a thermostat, opening window) ○ communication (e.g., using a telephone) • Home modifications for any of these problems should address the needs of both the person with upper extremity impairment and the caregiver(s). • Selecting the most appropriate modifications will depend on the situation, which may change over time. • Home modifications only provide opportunities for activities and tasks to occur; they will not fix problems by themselves. 	
J & c	<p>We hope you enjoyed the class. It is now time for you to go forth and modify.</p>	

ACTIVITY: MOBILITY/TRANSFER

Problem/ Underlying Cause	Specific Objective/ Design Goals	Home Modification Strategies
Getting in and out of the house due to decreased range of motion, strength, speed, and coordination	Change attributes of handrail gripping surfaces to facilitate handling (i.e., gripping, pushing and pulling)	<ul style="list-style-type: none"> • Change shape of the handrail cross section • Change size of handrail diameter (e.g., reduce to 1.25") • Change handrail material or surface texture
	Change location of handrail gripping surfaces to minimize reaching	<ul style="list-style-type: none"> • Install handrails on both sides of stair • Install second handrail at a convenient height
	Change attributes of key/door handle gripping surfaces to facilitate handling (i.e., facilitate or eliminate pinching, gripping and turning)	<ul style="list-style-type: none"> • Use an adaptive key aid • Use an adaptive door handle • Install lever handle
	Use alternative or automatic opening systems to eliminate reaching and handling (i.e., gripping, fingering, turning, pressing, pulling and pushing)	<ul style="list-style-type: none"> • Install electric or remote control lock • Install remote control door handle • Install lockset with fingerprint reader • Install keypad control deadbolt • Install automatic door opener

ACTIVITY: MOBILITY/TRANSFER

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Getting around the house due to decreased range of motion, strength, speed, and coordination	Change attributes of door handle gripping surfaces to facilitate handling (i.e., or eliminate pinching, gripping and turning)	<ul style="list-style-type: none"> • Use an adaptive door handle • Install lever or loop handle
	Use alternative or automatic opening systems to eliminate handling (i.e., gripping, turning, pressing and pulling)	<ul style="list-style-type: none"> • Install automatic door opener • Replace door with curtain • Replace door with a pocket door • Change door to swing in both directions (i.e., both sides are push sides)
	Change attributes of handrail gripping surfaces to facilitate handling (i.e., gripping, pushing and pulling)	<ul style="list-style-type: none"> • Change shape of the handrail cross section • Change size of handrail diameter (e.g., reduce to 1.25") • Change handrail material or surface texture
	Change location of handrail gripping surfaces to minimize reaching	<ul style="list-style-type: none"> • Install second handrail at a convenient height • Install handrails on both sides of stair

ACTIVITY: MOBILITY/TRANSFER

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Transferring on/off of furniture due to decreased range of motion, strength, and coordination	Change location of transfer supports to minimize reaching	<ul style="list-style-type: none"> • Use a chair with arms at the right height and that extend to front edge of seat • Install floor-to-ceiling pole with convenient gripping surfaces adjacent to chair or bed • Provide sturdy furniture adjacent to chair or bed
	Use alternative or automatic standing systems to eliminate reaching and handling (gripping, pushing and pulling)	<ul style="list-style-type: none"> • Provide a self-powered or electric lifting cushion • Provide a sit-to-stand lift chair • Install an overhead or portable lift system

ACTIVITY: PERSONAL HYGIENE

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Toileting due to decreased range of motion, strength, and coordination	Change attributes of grab bar gripping surfaces to facilitate handling (i.e., gripping, pushing and pulling)	<ul style="list-style-type: none"> • Use comfortable grab bar shape/finish • Use a 1 1/4" diameter grab bar • Change handrail material or surface texture
	Change location of grab bars to minimize reaching	<ul style="list-style-type: none"> • Use grab bars that cantilever from rear wall behind toilet or floor stanchions to reduce distance between toilet and grab bar • Install grab bars at a convenient height and location for individual • Install floor-to-ceiling pole with gripping surfaces at convenient locations • Use toilet safety frame
	Use alternative or automatic standing systems to eliminate reaching and handling (gripping, pushing and pulling)	<ul style="list-style-type: none"> • Use a sit-to-stand lift • Use portable or overhead lift
	Change location of toilet paper holder to minimize reaching	<ul style="list-style-type: none"> • Relocate toilet paper holder on wall or hang from grab bars • Raise toilet paper holder • Locate toilet paper holder adjacent to toilet on dominant or functional side of user
	Use alternative or automatic cleansing systems to eliminate reaching	<ul style="list-style-type: none"> • Use a self wipe toiletry aid or tissue holder • Install hands-free cleansing attachment or bidet
	Change attributes of manipulated surfaces on flush handle to facilitate handling (i.e., facilitate pressing /eliminate gripping and pushing)	<ul style="list-style-type: none"> • Install push button flush lever • Install a push button flush
	Use automatic flushing systems to eliminate reaching, and handling (gripping, pushing, and pressing)	<ul style="list-style-type: none"> • Install automatic flush system

ACTIVITY: HYGIENE

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Bathing due to decreased range of motion, strength, and coordination	Change attributes of faucet handle gripping surfaces to facilitate handling (i.e., facilitate pressing/eliminate gripping and turning)	<ul style="list-style-type: none"> • Add adaptive device to faucet handle • Install lever handle faucet
	Change location of faucet handle gripping surfaces to minimize reaching	<ul style="list-style-type: none"> • Locate handle on outer edge of tub or shower • Locate handle to be reachable from a seated position
	Change attributes of grab bar gripping surfaces to facilitate handling (i.e., gripping, pushing and pulling)	<ul style="list-style-type: none"> • Use comfortable grab bar shape/finish • Use a 1 1/4" diameter grab bar • Change handrail material or surface texture
	Change location of grab bars/transfer assists to minimize reaching	<ul style="list-style-type: none"> • Install grab bar at convenient heights and locations outside and inside fixture • Install vertical grab bars outside the tub and horizontal grab bars inside the tub • Install grab bars at multiple heights inside tub for transferring in/out as well as raising and lowering from the tub bottom • Use transfer bench or board
	Use alternative or automatic transfer systems to eliminate reaching and handling (gripping, pushing and pulling)	<ul style="list-style-type: none"> • Use an in-tub lift system • Use portable or overhead lift
	Change location of accessories to minimize reaching	<ul style="list-style-type: none"> • Install corner wall shelves or hanging shelf from shower arm • Install second clip for hand held shower in a convenient location
	Use alternative methods or automatic dispensing/drying systems to eliminate	<ul style="list-style-type: none"> • Use adaptive handles on sponges and brushes or a soap holder • Use soap-on-a-rope • Use automatic soap/shampoo dispenser • Attach pump handles to shampoo containers • Install a wall-mounted dryer

	reaching and handling (gripping, and turning)	
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ACTIVITY: HYGIENE

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
<p>Difficulty with hand hygiene due to decreased range of motion, strength, and coordination</p>	Change attributes of handle gripping surface to facilitate handling (i.e., gripping, holding and turning.	<ul style="list-style-type: none"> • Add adaptive device to faucet handle • Install single or double lever handle faucet
	Change location of handles to minimize reaching	<ul style="list-style-type: none"> • Locate handle on outer edge of sink counter tops
	Use alternative or automatic faucet systems to eliminate reaching and handling (i.e., gripping, turning, pressing, pulling, and pushing)	<ul style="list-style-type: none"> • Install motion activated faucet • Install foot and knee faucet controls
	Change location of sink/counter to facilitate reaching	<ul style="list-style-type: none"> • Lower sink counter to enable use from a seated position
	Change of gripping/ manipulated surfaces on doors/drawers to facilitate handling (i.e., facilitate gripping/ eliminate pinching and pulling)	<ul style="list-style-type: none"> • Use an adaptive drawer handles • Install lever or loop handles • Install magnetic touch latches on cabinet doors
	Change location or location of storage/accessories to minimize reaching	<ul style="list-style-type: none"> • Raise or lower shelves • Use drawers that pull out • Raise or lower sink counter • Relocate items to lower shelves or counters
	Use alternative or automatic grooming systems to eliminate gripping, turning, fingering, pressing, pulling, and pushing	<ul style="list-style-type: none"> • Use electric razor • Install wall-mounted dryer • Install soap dispenser • Mount grooming tools to a fixed or non-slip surface • Use a reacher stick

ACTIVITY: HYGIENE

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Dressing due to decreased range of motion, strength, and coordination	Change of gripping/ manipulated surfaces on doors/drawers to facilitate handling (e.g., facilitate gripping/ eliminate pinching, turning and pushing and pulling)	<ul style="list-style-type: none"> • Use an adaptive handles • Install lever or loop handles • Install magnetic touch latches on doors
	Use alternative or automatic opening systems to eliminate handling (i.e., gripping, turning, pressing and pulling)	<ul style="list-style-type: none"> • Install automatic door opener • Replace door with curtain • Replace door with a pocket door • Change closet doors to sliding or bifold doors
	Change location of clothes/storage to minimize reaching	<ul style="list-style-type: none"> • Lower closet shelves and clothes rod • Relocate items to lower shelves or other lower storage
	Use alternative or automatic clothing storage systems to eliminate reaching	<ul style="list-style-type: none"> • Install a revolving closet storage system • Install storage system with full extension drawers

ACTIVITY: HOUSEHOLD CHORES AND ACTIVITIES

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Preparing and eating meals due to decreased range of motion, strength, and coordination	Change location of stored items to minimize reaching	<ul style="list-style-type: none"> • Place frequently used items at the front of cabinets or on shelves that are at a convenient height
	Use alternative or automatic storage systems to eliminate reaching	<ul style="list-style-type: none"> • Install Lazy Susans in cabinets • Install pull-out shelves in cabinets • Install full extension drawers • Use refrigerator with sliding draws or shelves • Replace counters or cabinets with motorized models • Use a reacher stick
	Change location of appliances to minimize reaching	<ul style="list-style-type: none"> • Raise dishwasher • Lower cabinetry • Install microwave in base cabinet • Lower wall oven and range • Install oven with side opening door • Use side-by-side or bottom freezer refrigerator • Install wall oven with side opening door
	Change attributes of gripping surfaces/manipulated objects to facilitate handling (i.e., facilitate gripping and pressing/eliminate gripping and turning)	<ul style="list-style-type: none"> • Use adaptive appliance control handles to make knobs bigger or easier to grab and turn • Replace appliances with models that have push button controls at the front • Install lever or loop handles on cabinets or drawers • Use magnetic touch latches on cabinet doors • Install lever or loop handles on cabinets or drawers • Install single or double lever handle for faucet • Use adaptive or high friction rubber handles on utensils, pots, and pans • Use lighter pots and pans or ones with 2 handles
	Change attributes of transport surfaces to facilitate handling (i.e., facilitate pushing and minimize lifting)	<ul style="list-style-type: none"> • Install or create smooth surface on countertops for easy sliding of pots and plates • Replace stove with model that has a smooth glass top for easy sliding of pots • Provide pull out shelves adjacent to appliances for sliding of objects • Provide rolling cart to transport objects • Remove clutter from counters

ACTIVITY: HOUSEHOLD CHORES AND ACTIVITIES

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Laundry due to decreased range of motion, strength, and coordination	Change location of stored items to minimize reaching	<ul style="list-style-type: none"> • Place detergents and supplies within reach • Lower storage shelves to a comfortable height
	Use alternative or automatic storage systems to eliminate reaching	<ul style="list-style-type: none"> • Install pull-out shelves • Install full extension drawers • Replace counters or cabinets with motorized adjustable height models • Use a reacher stick
	Change location of appliances to minimize reaching	<ul style="list-style-type: none"> • Replace washer and dryer with front loading units that have controls and lint trap on the front instead of the back • Raise front loading appliances to make them easier to reach inside
	Change of gripping/ manipulated surfaces on doors/drawers to facilitate handling (i.e., facilitate gripping and pressing/eliminate gripping and turning))	<ul style="list-style-type: none"> • Use adaptive appliance control handles to make knobs bigger or easier to grab and turn • Replace appliances with models that have push button controls at the front • Install lever or loop handle on cabinets or drawers • Use magnetic touch latches on cabinet doors • Install lever or loop handle on cabinets or drawers • Install single or double lever handle for faucet • Use adaptive or high friction rubber handles on utensils, pots, and pans
	Change attributes of transport surfaces to facilitate handling (i.e., facilitate pushing and minimize lifting)	<ul style="list-style-type: none"> • Install or create smooth surface on countertops for easy sliding of laundry • Provide pull out shelves adjacent to and at door height of appliances for sliding of objects • Install laundry chute from floor above (if not on same floor) • Provide rolling cart to transport objects • Use a folding table next to dryer • Remove clutter from counters

ACTIVITY: HOUSEHOLD CHORES AND ACTIVITIES

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Cleaning, organizing and maintaining home due to decreased range of motion, strength, and coordination	Change attributes of gripping surfaces on tools to facilitate handling (i.e., gripping)	<ul style="list-style-type: none"> • Use adaptive handles on tools • Use soft-handled tools that are easy to grip
	Use alternative or automatic transport and cleaning systems to eliminate reaching and handling (i.e., gripping, turning, pressing, pulling and pushing)	<ul style="list-style-type: none"> • Use a rolling cart to move items from one room to another • Use an automatic or robotic vacuum cleaner that propels itself

ACTIVITY: HOUSEHOLD CHORES AND ACTIVITIES

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Managing finances due to decreased range of motion, strength, and coordination	Change attributes of gripping surfaces or manipulated objects to facilitate handling (i.e., gripping)	<ul style="list-style-type: none">• Use adaptive grips on pens and pencils• Use calculator with larger buttons
	Use alternative or automatic systems to eliminate reaching and handling (i.e., fingering, gripping, turning)	<ul style="list-style-type: none">• Use the computer to pay bills or set up automatic bill pay• Use automatic letter opener• Use writing guides to help steady handwriting

ACTIVITY: CONTROL OF AMBIENT CONDITIONS

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Regulation of temperature due to decreased range of motion, strength, and coordination	Change attributes of gripping surfaces on controls to facilitate handling (i.e., gripping, turning, squeezing, and pressing)	<ul style="list-style-type: none"> • Replace thermostat with large dial or one with large push buttons • Add a large knob to the end of the pull chain on fan • Use adaptive handles on heating and air conditioning units
	Change location of controls to minimize reaching	<ul style="list-style-type: none"> • Lower thermostat on wall • Locate thermostat on a wall that is clear of furniture and other obstacles • Make pull chain on fan longer •
	Use alternative or automatic control systems to eliminate reaching and handling (i.e., fingering, gripping, turning, and pressing)	<ul style="list-style-type: none"> • Replace thermostat with a programmable model • Install gas ignition or fire logs with push button start • Replace thermostat with model that is voice activated • Replace fan with a remote control model or purchase add-on unit

ACTIVITY: CONTROL OF AMBIENT CONDITIONS

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Regulating light due to decreased range of motion, strength, and coordination	Change attributes of manipulated objects on controls to facilitate reaching, gripping and fingering	<ul style="list-style-type: none"> • Add a large pull knob to the end of the pull chain on light • Replace wall switches with rocker switches
	Change location of controls to minimize reaching	<ul style="list-style-type: none"> • Install switch extender rod • Lower light switch on wall • Locate switch on a wall that is clear of furniture and other obstacles • Increase length of pull chain on light
	Use alternative or automatic switches to eliminate reaching and handling (i.e., fingering, pinching, pressing, turning)	<ul style="list-style-type: none"> • Use foot pedal switches • Use switch extension rods • Use sound or voice activated control lighting • Use X-10 or similar remote control unit for alternative switch access • Install programmable system • Install motion activated lighting • Install photosensitive lighting • Install remote control blinds • Install automatic curtain opener/closer

ACTIVITY: CONTROL OF AMBIENT CONDITIONS

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Operating windows due to decreased range of motion, strength, and coordination	Change attributes of gripping surfaces on controls to facilitate handling (i.e., facilitate gripping and turning/eliminate pushing and pulling)	<ul style="list-style-type: none"> • Install casement windows with larger crank handles • Adapt windows with crank handles
	Change location of controls to minimize reaching	<ul style="list-style-type: none"> • Install casement windows with larger crank handles • Adapt windows with crank handles

ACTIVITY: COMMUNICATION AND RESPONSE

Problem/ Underlying Symptoms	Specific Objective/ Design Goals	Home Modification Strategies
Using telephone due to decreased range of motion and coordination	Change attributes of controls to facilitate handling (e.g., pressing)	<ul style="list-style-type: none"> • Use telephone with large buttons
	Change location of phone to minimize reaching	<ul style="list-style-type: none"> • Locate phone in area that is free of obstacles • Lower wall phones • Carry remote phone on person
	Use alternative or automatic activation systems to eliminate reaching and handling (e.g., gripping and pressing)	<ul style="list-style-type: none"> • Use telephone with alternative switch access • Use telephone with programmable buttons or voice dialing • Use voice activated speakerphone