Physical Activity Guidelines for People with Alzheimer's Disease of Various Ambulatory and Cognitive Status

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Abstract

With the rapidly growing elderly population in the United States, the number of people diagnosed with dementia and Alzheimer's Disease (AD) is increasing dramatically. For these patients, it is crucial to slow the rate of progression. Research has proven that exercise improves cognition, and recent findings suggest a similar association among those with AD. However, this is complicated by the large majority of AD patients becoming non-ambulatory as the disease progresses. Thus, there is a large gap in the literature to meet the needs of non-ambulatory AD patients working to slow their disease's progression. The first purpose of this article is to summarize the existing research that demonstrates the positive effects that exercise has on the elderly and patients with AD. The second purpose is to provide activities that can enhance the cognitive and physical function of AD patients with various ambulatory and cognitive status. Recommendations for further research into various programs' physiologic effects on AD patients are offered, as well as some tools that may help with data collection.

Physical Activity Guidelines for People with Alzheimer's Disease of Various Ambulatory and Cognitive Status

Alzheimer's Disease (AD) is a neurodegenerative disorder that adversely affects neurons in the brain. Characteristic symptoms of AD include memory loss, difficulty with language, behavioral disturbances, and a growing dependence on caregivers. With AD, neurons affecting cognitive functions are damaged and destroyed; with time however, neurons in the parts of the brain that control basic bodily functions like ambulating and swallowing are affected as well. Towards the later stages of AD, patients are typically bed bound and require professional care.

Like many diseases, the risk of AD increases exponentially with age, doubling every five years after the age of 65 (California Workgroup, 2008). Put simply, the proportion of people with AD increases with age. In combination with the demographic shift in the United States, this suggests that AD will become very prevalent in the elderly population, specifically the old-old group. In 2019, an estimated 5.8 million, or 1.6% of the American population, had AD. The Centers for Disease Control and Prevention (CDC) project that by 2060, 13.9 million, or 3.3% of the American population, will have AD or another dementia. This will correspond with an immense economic burden. In 2019 alone, the estimated cost of health care and Hospice care for those with AD and other dementias was $290 billion. Further, a huge responsibility will fall upon care providers. Eighteen and a half billion hours of informal care were estimated to have been provided to AD and dementia patients in 2018. (2019 Alzheimer's Disease Facts and Figures)

Luckily, there is research that has confirmed that being physically active can prevent, delay, and slow the progression of AD. Longitudinal, observational, and randomized controlled trials have demonstrated the beneficial relationship between exercise and cognitive function (Barnes, 2011). Conversely, a sedentary lifestyle is related to an increased risk of AD (Barnes, 2011). Unfortunately, as patients with AD lose their physical and cognitive abilities, it becomes less clear how they can remain active.

A large proportion of the elderly population is ambulatory (AMB), meaning able to walk. Many are also assisted ambulatory (ASST), meaning able to walk with an aid, whether it be a cane, walker, or care provider. Yet, the majority of patients with AD eventually become non-ambulatory (NON), meaning they are unable to walk around (Lee, 2019). Being bed-bound makes patients vulnerable to other conditions that can lead to organ failure and death (Alzheimer's Association, 2018) Thus, it is important that physical activity guidelines are proposed and tested on their cognitive and physical effects within elderly populations with AD. This article serves to synthesize the existing research that led to the subsequent creation of Physical Activity Guidelines for People with Alzheimer's Disease of Various Ambulatory and Cognitive Status.

Research

Physical Activity and Risk for Alzheimer's Disease

Studies have demonstrated a strong relationship between exercise and AD. On one hand, physical inactivity is associated with an increased risk for cognitive impairment (Barnes, 2011). These findings were reinforced by the randomized controlled trials (RCT's) Barnes analyzed that showed healthy sedentary people increased their

cognitive function, particularly their mental processing speed, through participating in an exercise program. Among people with AD, increasing physical activity served to increase cognitive function in the large majority of RCT's (Groot, 2016) (Phillips, 2015). It is worth noting that the studies they analyzed included extensive variations in age, sex, ambulatory status, dementia diagnosis, and cognitive tests used, yet nearly all reported positive results (Phillips, 2015). Their results showed improved cognitive function after intervention when compared to baseline. Another study by Landi in 2004 evaluated the behavioral influences of an exercise group compared to a control group in a nursing home for the frail and elderly with dementia. They found that there was a statistical decrease in wandering, physical and verbal abuse, and sleep disorders among the intervention group that permitted a significant decrease in their medications. This benefit to exercise programs should not be overlooked; polypharmacy can be reduced through the non-pharmaceutical therapy of physical activity. In conclusion, it is evident that physical activity and exercise can help to manage the decline of cognition among the elderly with AD.

Physical Activity and Frailty

Aside from its cognitive benefits, physical activity has also been shown to improve the physical function of the frail and elderly. Frailty is an increased stage of vulnerability to disease, falls, and disabilities. Numerous studies demonstrated that, contrary to popular belief, elderly adults should be encouraged to exercise and stay active. "It is important to note that frailty is not a contraindication for physical activity. On the contrary, it may be one of the most compelling reasons to prescribe physical exercise" (Landi, 2010). Positive adaptations were found in frail, elderly populations who

started on an exercise prescription to reverse frailty (Bray, 2016). Some studies found that exercise programs that totaled between 100-150 active minutes per week, including aerobic, resistance, balance, and flexibility training, were effective in managing frailty (Bray, 2016) (Theou, 2011). There was also literature revealing the ambiguous conclusions from this research; while it is evident that physical activity helps to manage and reverse frailty, the ideal intervention has not been established (de Labra, 2015). Further, some studies expressed the difficulties they faced in implementing exercise programs as their subjects' ambulatory and health status declined (Schnelle, 1996). In conclusion, the studies demonstrated the benefits of exercise for the old and frail, though the exact methodology that would prove most effective for the variety of functional levels seen among elderly patients remains unclear.

Aerobic Exercise for Managing Alzheimer's Disease

There are strong associations between aerobic exercise and its physical and cognitive benefits for the human body. Among elderly patients with AD, recent research has shown similar trends for exercise's role in improving gait, cognitive, cardiorespiratory fitness, and neuropsychiatric symptoms. A pilot study by Landi in 2004 revealed the neuropsychological benefits that accompany exercise among AD patients. As their AD symptoms declined, their behavior-managing medications were reduced or eliminated. A controlled trial from 2011 showed similar improvements in neuropsychiatric symptoms following a motor intervention (Stella, 2011).

In various controlled trials, researchers revealed that cognitive functioning improved among patients who participated in exercise programs. In a controlled trial looking at elderly patients with dementia, the intervention group involved in an exercise

program showed slowed cognitive decline and improved gait, while the control group declined in both measures (Kemoun, 2010). A similar study by Coelho in 2013 yielded the same results of enhanced cognitive function and walking among AD patients following a multimodal exercise intervention. A RCT from 2011 demonstrated similar cognitive and physical improvements, in addition to gains of independence, among community-dwelling AD patients undergoing an exercise program (Vreugdenhil, 2011). Another RCT revealed the verbal and spatial memory improvements accompanying an exercise program among elderly patients with probable Mild Cognitive Impairment (MCI) (Nagamatsu, 2013). A controlled trial assessing individuals with AD's cognitive and postural changes following a multimodal exercise intervention outperformed the control group in various measures of frontal cognitive function, postural control, and functional capacities (de Andrade, 2013). A home-based exercise program was also found to be beneficial for AD patient's independence and functional performance (Steinburg, 2008). Another controlled trial evaluating AD patients living in a care facility compared the intervention group, who engaged in a walking program for six months, to the control group who received standard care. Evidenced by the 6-minute walking test (6WT), the Barthel Index of ADL's, and the Mini-Mental State Examination (MMSE), the walking group improved their walking capacity and ability to perform ADL's. Further, while the walking group's cognitive function declined -13%, the control group declined -47% based on the MMSE (Venturelli, 2011). Altogether, these results thoroughly demonstrate the protective effects of exercise and physical activity on AD patients' physical and cognitive decline.

Many systematic reviews and meta-analyses came to similar conclusions (Phillips, 2015) (Hernández, 2015) (Groot, 2016) (Bherer, 2013) (Etnier, 2006) (Lee, 2020) (Chen, 2020) (Lautenschlager, 2019).

Dance Therapy for Alzheimer's Disease

An alternative therapy to aerobic exercise is dance therapy which may offer motor and non-motor benefits to both patients and caregivers. With appropriate music selection and a skilled instructor, dance therapy offers a creative aerobic experience that can bring out positive mood changes and social interactions (Guzmán-García, 2013) (Gomaa, 2020). Though not as structured as other forms of exercise, dance therapy can serve to break up bouts of inactivity common among the elderly, particularly those with conditions that leave them ASST or NON. It may also be an appropriate therapy to offer patients who otherwise fail to adhere to exercise recommendations (Dhami, 2015) but would benefit from its cognitive and physical engagement.

Resistance Training for Managing Alzheimer's Disease

Maintaining muscular strength is critically important for the older population's functional fitness. On a physical level, sarcopenia and muscle atrophy are of great concern because they can predispose individuals to gait disorders, falls, fractures, and loss of independence due to difficulty with Activities of Daily Living (ADL's). Luckily, studies have shown that even low-intensity, high-repetition resistance training can have significant effects on muscle mass and quality among older people (Ikezoe, 2020).

Resistance training, like aerobic exercise, has also been revealed to bring about significant positive cognitive changes. In a 2007 study, Cassilhas utilized three groups, a control group, a moderate experimental group, and a high experimental group. After

undergoing a 24-week resistance training program, both experimental groups showed nearly equally beneficial cognitive results when compared to the control group. They were evaluated on physical, cognitive, mood, and hemodynamic parameters. Both intervention groups performed better on the 1-repetition max (1RM) test compared to the control. The cognitive assessments included were digit span forward, Corsi's block-tapping test backward, similarities, and the Rey-Osterrieth complex figure immediate recall. Both the moderate and high experimental groups performed better on the array of cognitive tests than the control group. Further, the experimental groups' mood assessments of general health, tension-anxiety, depression-dejection, anger-hostility, fatigue-inertia, confusion-bewilderment, and total mood disorder showed significant improvements in contrast to the control group. The similarities among the two experimental groups aligns with Groot's findings from 2016 that stated low and high-frequency interventions resulted in similar effects. In another study from Cassilhas in 2012, they found that among rats, resistance exercise improved learning and spatial memory similarly to aerobic exercise. Additionally, a study involving healthy elderly men compared a control group to a resistance training intervention group to suggest that resistance exercise may be an effective means of altering the trajectory of cognitive decline. They proposed that Insulin-like Glucose Factor-1 (IGF-1), whose serum levels increase with exercise training, may have a protective effect on age-related decline in executive functioning (Tsai, 2015). Therefore, it is evident that resistance training, not unlike aerobic exercise, can be an effective non-pharmaceutical treatment for both physical and cognitive decline among the elderly with AD.

Physical Activity Recommendations

The American College of Sports Medicine (ACSM) recommends for older adults with AD to perform 150 minutes of moderate-intensity aerobic activity per week along with resistance training 2 days each week. For aerobic exercise, they suggest performing any rhythmic, continuous activity most days of the week at a light to somewhat hard intensity. The ACSM emphasizes the importance of starting cautiously, with just a few minutes of low-intensity activity preceded by a warm-up and followed by a cool down. If this standard is unattainable, recall that any activity is better than no activity.

Regarding strength training, ACSM recommends that AD patients perform resistance training at least two days a week. As with aerobic exercise, start conservatively. Use light weights to perform 1-3 sets of 8-12 repetitions.

These guidelines match the average exercise program's Frequency-Intensity-Time-Type (FITT) plan of many studies that looked into physical activity interventions among the elderly with AD. Theou's systematic review from 2011 included 75 published articles that detailed 47 studies examining exercise interventions to manage frailty among elderly adults with and without AD. The most common programs they analyzed included approximately three sessions of 60 minutes each week for at least three months (Theou, 2011). Interestingly, when comparing RCT's that assessed exercise's role in cognitive function with dementia, Groot concluded that high- and low-frequency interventions yielded similar cognitive benefits (Groot, 2016). Regardless, the physical adaptations that come from greater amounts of exercise should not be ignored.

Physical Activity Among Patients of Various Ambulatory Status

For patients that are ambulatory, the ACSM's recommendations for activity among AD patients can be a helpful guide. However, the majority of AD patients become NON. A study by Lee from 2019 found that of the 34,040 subjects included in the studies they analyzed, 27,243 were ASST or NON. This statistic demonstrates the dire need for physical guidelines that are appropriate for a wider variety of AD patients.

Exercise and Activity Instructions

The second purpose of this project is to offer exercises for NON, ASST, and AMB patients with AD to help slow the associated cognitive and physical declines. Below, General Tips as well as specific exercise instructions based on patients' cognitive and ambulatory status are listed.

General Tips

- When new activities are introduced, patients may struggle with the exercises. People with AD often cannot comprehend what they should be doing when in new situations. After a few sessions, they will likely get more comfortable with the novel routine, movements, and equipment.
- To help accelerate the patient's familiarization, schedule the activity at the same time every day so it becomes a habit. Times of day when AD symptoms are least severe are ideal. See Appendix A, B, and C for more detail.
- Learn whether the patient enjoys one-on-one or group settings. Some patients may enjoy exercising with others, while some would prefer privacy.
- Encourage movement that crosses the midline of the patient's body. This is often something that elderly and impaired brains struggle with.

- Find which forms of feedback motivate the patient the most. Progress charts, verbal praise, and social engagement can all serve as motivators depending on the patient's temperament.
- Consider performing exercises with the patient. This can help patients view exercise as a fun, social activity rather than a treatment to endure.
- For patients who struggle or are unable to follow directions, leading by example can be an effective way to communicate.
- Utilize one-step cueing, a form of simple, easy-to-follow steps, to keep instructions concise and ensure greater comprehension. This prevents patients from being overwhelmed and unable to follow a battery of instructions. See Appendix D for more detail.
- Don't push the patient too hard. Start slow and monitor for signs of frustration and fatigue. By starting with just a few minutes of exercise here and there, patients can build up their aerobic capacity and tolerance for exercise. Gradually work the patient up to 150 minutes per week (American College of Sports Medicine, 2019). If this is unattainable, remember that any activity is better than none.

Exercise Instructions

Timed Walk

- To avoid injury and extreme fatigue, start the patient with walking for 1 minute continuously. If completed, add an additional minute for the next session. If unsuccessful, develop lower leg endurance with chair exercises, timed marching, and walks <1 minute.

- If the patient is resistant to exercise, suggest they walk a bit extra when moving from their spot to the bathroom or kitchen table to increase their activity.
- Many patients may be motivated by a chart that shows their progress. By timing how long patients can walk without a break, caregivers can document their improvement.
- Ensure that patients have on proper footwear and start with flat surfaces. Use a gait belt if needed.
- If appropriate, challenge the patient by walking outside, on stairs with a rail, or around 1 or 2 obstacles to develop their balance.
- For non-ambulatory patients, timed marching can be a good alternative to timed walking. Encourage the patient to lift and lower their knees through the greatest range of motion they can comfortably perform.

Bike Pedaling

- If appropriate, have the patient use a stationary bicycle. If a seated bike is too difficult, stationary foot pedals are a safe alternative. Arm ergometry is another alternative that may be appropriate for some patients.
- Start the patient biking for 1 minute. If completed, add an additional minute for the next session. If unsuccessful, develop endurance with chair exercises and cycling sessions <1 minute.
- Encourage patients to pedal at an intensity that makes them feel tired, without impeding their ability to talk.

- Many patients may be motivated by a chart that shows their progress. By timing how long patients can cycle without a break, caregivers can document their improvement.
- Patients may be more likely to continue cycling if they are entertained by conversation, television, or a book while they exercise (i.e. depending on fitness, caregivers can encourage the patient to bicycle either during commercial breaks or the program itself).

Balloon Toss

- Start by batting the balloon back and forth between the patient and caregiver using both hands for 2 minutes.
- Encourage the patient to return the balloon using just their dominant hand, and then just their non-dominant hand, with 2 minutes designated for each side. Purposefully toss the balloon such that the patient will need to reach and cross their body's midline to return the balloon.
- Using two hands, catch and toss the balloon with the patient. Together, count out loud how many successful catches and throws there are in a row. Perform this for 2 minutes.
- If appropriate, toss the balloon at their feet so they can kick to engage their leg muscles. Start with 2 minutes of balloon kicking.
- Based on the patient's fitness, gradually increase the time spent performing each balloon activity.

Soft Weights

- Select a weight for the patient that they can perform between 10 to 15 repetitions with. Alternatively, encourage the patient to perform each exercise for 1 minute. Slowly increase the prescribed repetitions or time as their fitness improves.
- Alternatives to traditional dumbbells are 1- or 2-pound soft weights, partially or completely filled 16.9-ounce water bottles, 16-ounce soup cans, and 2-ounce tennis balls. Using the patient's body weight alone may also be appropriate to start with.
- Encourage the patient to hold a weighted object in each hand and perform arm movements (i.e. bicep curls, triceps extensions, shoulder shrugs, shoulder abduction, and shoulder flexion). See Appendix D and E for more detail.
- If the patient is unable to perform many repetitions, encourage them to perform an isometric hold instead. Time how long the patient is able to maintain the position and motivate them to improve the next session.
- If in a group setting, while seated in a circle, have patients and caregivers pass objects of various weights and sizes to those next to them. This helps patients cross their midline, socially engage with others, and respond appropriately to objects of various weights.

Dance Therapy

- If appropriate, ask the patient what kind of music they would like. If they are unable to communicate, select the genre, songs, and artists based on their age.
- Dancing can be performed from a seated or standing position.

- The caregiver may lead the patient through arm movements and footsteps to follow or allow the patient to move on their own. Use trial-and-error to see what the patient seems to enjoy more.
- Learn whether the patient prefers one-on-one or group settings.
- For environments where caregivers will lead the patients through movements, emphasize arm and leg range of motion and intentionally shifting weight forward, backward, and laterally.
- For ASST and AMB patients, caregivers can embrace patients in a ballroom-style frame to offer them support as they shift their weight and rhythmically march in place.

Physical Activity Guidelines Chart for People with Alzheimer's Disease of Various Ambulatory and Cognitive Status

Guidelines for Physical Activity for People with Alzheimer's Disease		Ambulatory Status		
		Ambulatory	**Assisted-Ambulatory**	**Non-Ambulatory**
Cognitive Status	**Can follow directions**	Timed walk Bike pedaling Soft weights Balloon toss Dance therapy	Timed walk Bike pedaling Soft weights Balloon toss Dance therapy	Timed marching Bike pedaling Soft weights Dance therapy
	Struggles to follow directions	Timed walk Bike pedaling Soft weights Balloon toss Dance therapy	Timed walk Bike pedaling Soft weights Balloon toss Dance therapy	Timed marching Bike pedaling Soft weights Dance therapy
	Unable to follow directions	Timed walk Bike pedaling Balloon toss Dance therapy	Timed walk Bike pedaling Balloon toss Dance therapy	Timed marching Balloon toss Dance therapy

Conclusion

The accumulation of evidence demonstrating the positive cognitive, physical, neuropsychiatric, and functional capacity changes resulting from exercise programs confirms the significant effects physical activity can have on patients with AD. Therefore, it is recommended that similar programs are implemented in facilities and homes treating patients with AD to relieve the burden on caregivers and elevate the cognitive function, physical independence, and quality of life of patients.

It should be noted, however, that NON and ASST AD patients in the later stages of the disease were not included in the cited studies. It is critical that further studies examine the extent to which modified physical activity programs, such as that proposed in this article, can benefit these patients. Exercise programs should be prescribed with a wider population in mind, such that even patients with late-stage AD are eligible for exercise therapy.

Recommendations for Further Research

This project should serve as a skeletal structure for future grants and research studies. Each could benefit greatly from a pilot study that would involve a few patients with AD that begin an exercise program and have their cognitive and physical function assessed at the beginning, midpoint, and conclusion of the study. If feasible, more regular testing, say weekly or monthly, could serve to give researchers more data. Additionally, same-day assessments an hour before and after the exercise intervention may demonstrate the acute effects of physical activity on AD patients' cognitive and motor function. More thorough investigations could also assess how exercise programs affect AD patients' vitals, continence, weight, and body composition.

Cognitive assessments that are sensitive to the participants' stage of decline should be administered regularly throughout the study. The Bedford Alzheimer's Nursing Severity Scale (BANS-S) appears to be most sensitive to severe AD. Other commonly used cognitive assessments include the Mini-Mental State Examination (MMSE), Katz Activities of Daily Living Scale, Clinical Dementia Rating (CDR) scale, and Modified Test for Severe Impairment (mTSI).

Additionally, more exercise-based RCT's should focus on facility-based and in-home care settings for AD patients, as these will paint a more accurate picture of the effectiveness of exercise programs in real life. Facility barriers such as insufficient staffing and time to implement such programs should be addressed (Gomaa, 2019). Hiring new employees for the purpose of implementing an exercise program among residents in a nursing home or community may alleviate this burden. Funding would be required to resolve this issue as well as purchase the necessary exercise and safety equipment.

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Appendix A

Daily Schedule for a Severely Demented AMB-AD Patient Living in a Care Facility

800: Patient wakes up and performs ADL's with moderate assistance.

930: Patient ambulates to join other residents at the tables for breakfast.

1030: After finishing breakfast, patient visits the bathroom and settles in the living room. They are provided a cognitive assessment.

1100: Patient spends time socializing, reading, watching television, and napping.

1130: Patient is guided through exercises: timed walk, balloon toss, and dance therapy.

1200: Patient visits the bathroom again before napping.

1400: Patient ambulates to join other residents at the tables for lunch.

1500: After finishing lunch, patient visits the bathroom and settles in the living room. They are provided a cognitive assessment.

1600: While watching television, some commercial breaks are utilized by caregivers to engage the patient in balloon toss and bike pedaling.

1800: Patient ambulates to join other residents at the tables for dinner.

1900: After finishing dinner, patient visits the bathroom and settles in the living room to watch television until ready for bed.

2100: Patient ambulates to the bathroom to change into pajamas and prepare for bed.

2130: Patient rests in bed.

Appendix B

Daily Schedule for a Severely Demented ASST-AD Patient Living in a Care Facility

800: Patient wakes up and is assisted from bed. Patient performs ADL's with moderate assistance.

930: Patient uses walker to join other residents at the tables for breakfast.

1030: After finishing breakfast, patient uses walker to ambulate to the bathroom with moderate assistance.

1100: Patient settles into their spot in the living room to socialize, read, watch television, and nap. First, they are provided a cognitive assessment.

1130: Patient is guided through exercises: timed walk using walker, balloon toss, and dance therapy.

1200: Patient visits the bathroom with moderate assistance before napping.

1400: Patient uses walker to join other residents at the tables for lunch.

1500: After finishing lunch, patient visits the bathroom with moderate assistance and then settles in the living room. They are provided a cognitive assessment.

1600: While watching television, some commercial breaks are utilized by caregivers to engage the patient in balloon toss and bike pedaling.

1800: Patient uses walker to join other residents at the tables for dinner.

1900: After finishing dinner, patient visits the bathroom with moderate assistance and settles in the living room to watch television until ready for bed.

2100: Patient uses walker to ambulate to the bathroom and change into pajamas to prepare for bed.

2130: Patient rests in bed.

Appendix C

Daily Schedule for a Severely Demented NON-AD Patient Living in a Care Facility

800: Patient wakes up and is changed in bed. After being transferred to wheelchair, patient performs ADL's with maximal assistance.

930: Patient is moved to join other residents at the tables for breakfast.

1030: After finishing breakfast, patient is transferred into their reclining chair in the living room to socialize, read, watch television, do crafts, and nap. They are provided a cognitive assessment.

1130: Patient is guided through exercises: timed marching, balloon toss, and dance therapy.

1400: Patient is transferred into wheelchair and joins residents at the tables for lunch.

1500: After finishing lunch, patient is brought to the bathroom with maximal assistance and then transferred back into their reclining chair in the living room. They are provided a cognitive assessment.

1600: While watching television, some commercial breaks are utilized by caregivers to engage the patient in balloon toss and bike pedaling.

1800: Patient is transferred into wheelchair and moved to join other residents at the tables for dinner.

1900: After finishing dinner, patient settles in the living room to watch television until ready for bed.

2100: Patient is moved to the bathroom to change into pajamas to prepare for bed with maximal assistance.

2130: Patient is transferred from their wheelchair into bed.

Appendix D

One-step cueing is very helpful for AD patients and their caregivers. Rather than explaining all of the parts of an activity up front, one-step cueing relies on short, concise statements delivered throughout the activity. When encouraging an AD patient to utilize soft weights to perform shoulder abduction, the dialogue could go as follows:

"First, let's pick up the weights."

Once the patient has the weights in their hands, you can deliver the next instruction. If they do not seem to understand what to do, try repeating the same short phrase. If the patient still seems confused, exemplify the action and help their hands grip the weights.

"Next, hold your arms at your side."

Once the patient has their arms at their side, you can deliver the next instruction. If they do not seem to understand what to do, try repeating the same short phrase. If the patient still seems confused, exemplify the action and help lower their hands to their sides.

"Perfect. Now, slowly raise your arms out to the side."

Once the patient has abducted their arms, you can deliver the next instruction. If they do not seem to understand what to do, try repeating the same short phrase. If the patient still seems confused, exemplify the action and help raise their arms to the side.

"Great! Now slowly lower your arms down."

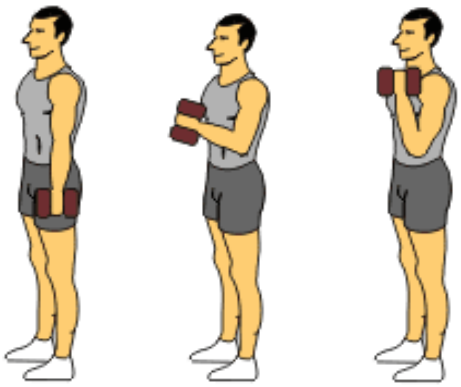
Once the patient has adducted their arms, you can deliver the next instruction. If they do not seem to understand what to do, try repeating the same short phrase. If the patient still seems confused, exemplify the action and help lower their arms.

"Good job! That was one. Let's try for another," and so on.

Appendix E

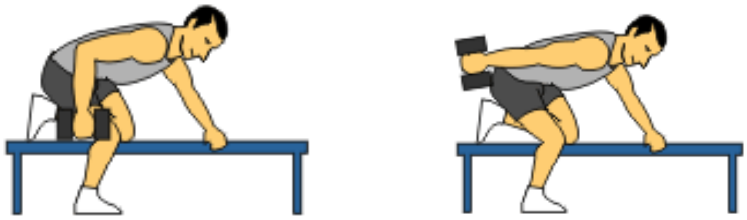
Each of the following exercises can be performed using body weight alone, or with an additional weighted object. Proper form and appropriate weights are important for safety of the patient. If using weights, do not swing them. Use slow, controlled motions. To properly challenge the patient, recall that performing a unilateral, or single-arm movement, can be easier than performing the movement bilaterally, or with both arms. Always begin conservatively and progress the patient gradually.

Bicep Curl: Start the patient with their arms straightened by their sides and their palms facing forward. Have them engage their biceps to bend their arm at the elbow and raise their hand from hanging position to shoulder level. Then, they may slowly lower their hand back to starting position.



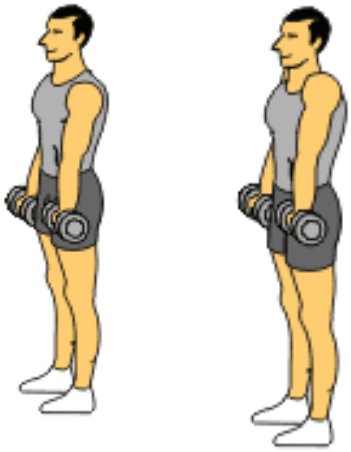
(Anderson, 2018)

Triceps Kickbacks: If standing, have the patient bend at the hips and knees with their feet shoulder distance apart to assume a slight bent-over position. If seated, have the patient bend at the hips to lower their chest closer to their legs. Instruct the patient to start with their upper arms against their sides and their elbows bent to 90-degrees. Then, have the patient straighten and extend their lower arm behind them. Next, they can slowly bend their elbow to return to the starting position.



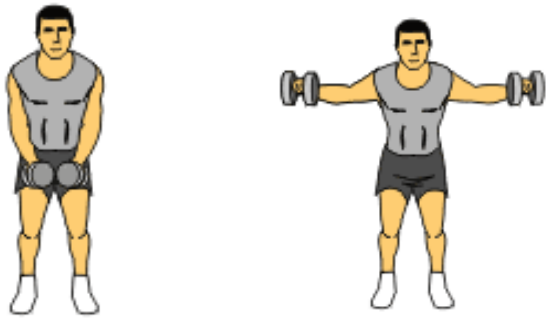
(Anderson, 2018)

Shoulder Shrugs: Have the patient sit or stand with good posture. With their arms straightened by their sides, have the patient engage their trapezius to shrug their shoulders and bring their deltoids closer to their ears. Then, the patient can slowly return to a normal posture.



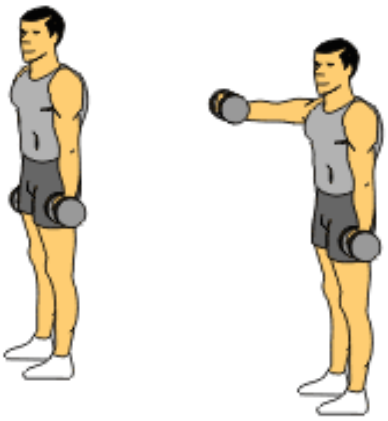
(Anderson, 2018)

Shoulder Abduction: Have the patient start with their upper arms against their sides and their elbows bent to 90-degrees. Then, the patient can lift their arm away from their body's center and up to shoulder height. Have the patient slowly lower their arm back to starting position. For greater difficulty, perform the same abduction with straight arms.



(Anderson, 2018)

Shoulder Flexion: Starting with both arms by their sides, the patient should pronate their lower arm such that their palms face behind them. Then, have the patient slowly raise their arm forward until they reach shoulder height. Then, they can slowly lower their arm back to starting position.



(Anderson, 2018)