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# EXERCISE IN FRAIL OLDER ADULTS

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*Research supports a range of options that can provide benefit.*

After admission to a long-term care facility, elderly people commonly become increasingly sedentary, and the decrease in activity can have adverse effects on basic physical functioning and the ability to perform common activities of daily living. Researchers conducted a systematic review of the literature to determine the components of an optimal exercise program for the prevention of frailty among residents of long-term care facilities and older adults living in the community.

The authors considered articles reporting randomized, controlled trials that investigated the effects of exercise on performance measures of physical functioning in frail elderly people. The 18 studies included in the review describe diverse exercise programs involving resistance, endurance, balance, and flexibility training given mostly two or three times weekly for 45 to 60 minutes per session. The authors note that professionals who work with older adults often underestimate their functional abilities and could offer them more challenging exercise programs. Further, the authors' review suggests that costly exercise equipment is not necessary to improve physical functioning.

The crux of the matter. Exercise is an important factor in maintaining health and physical functioning throughout life. Health care professionals should not underestimate the ability of older adults to engage in physical activity of varied intensity.

Chin A Paw MJM, et al. *Long-term Care Interface* 2007;8(6):14-6, 19.

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# The promise of strength training: are the frail elderly past beneficial strength building? Think again

## Nursing Homes, Sept, 2004

Imagine what would happen to your quality indicators if Mrs. Smith could discard her feeding tube and feed herself. Or if Mr. Jones could rise from the confines of his bed and walk down the hall with his cane. Imagine the possibilities in enhanced quality of life and reduced burden of care if residents could do more for themselves. Such is the promise of strength training for nursing home residents.

"We liken strength training to sports medicine for 95-year-olds," says Mark Richards, national director of clinical services at Aegis Therapies. "It is exciting that a frail nursing home population can exercise and realize huge increases in strength and, more importantly, improved functional ability."

One of the most common sources of increasing frailty among the elderly is muscle weakness--often simply from inactivity. "Many people are in nursing facilities because they have lost their strength and can no longer perform the activities of daily living or keep themselves sufficiently mobile," says Richards. But muscle weakness can be reversed.

A groundbreaking study published in 1990 in the Journal of the American Medical Association by Maria Fiatarone, MD, at the Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University in Boston, involved ten females, mean age 92, living in a nursing home. After exercising three times a week for eight weeks on strength-building machines, using 80% of their ability, these women increased their strength an average of 174%. No injuries were reported, nor any worsening of medical problems. Their increased strength translated into a 48% increase in walking speed.

Dr. Fiatarone went on to publish another study in 1994 in the New England Journal of Medicine involving 100 nursing home residents with diagnoses ranging from arthritis to lung disease to dementia. Residents worked on exercise machines for resistance training three times a week to strengthen their thighs and knees. After a ten-week period, their muscle strength increased 113%, walking speed accelerated by 12%, and ability to climb stairs rose by 28%. Four residents were able to discard their walkers and walk with only a cane.

"The advantage of using such machines in the strength-building process is that they provide the postural support people need to safely exercise," explains Richards. "The machines also control the exercise range of motion and, to provide resistance, allow us to increase the load by increments as small as one pound at a time."

As the frail become stronger, they spend less time in bed, move more easily around their rooms, and participate in more activities of daily living--all reportable as enhanced chronic-care measures endorsed by the National Quality Forum.

strength-building program."

Aegis's Richards notes that establishing a good strength-training program involves more than simply installing the machines. "It's the protocols and the training of our clinicians and facility staff, as well as the ongoing clinical management, that make a difference," he says. "We track utilization on a weekly, patient-by-patient basis, and we have a training network and clinical support system that provide ongoing monitoring. That's what makes for a successful program."

As a facility's quality indicators and quality measures improve, the cost of caregiving is reduced. According to a study by the Uniform Data Set (UDS), which governs the FIM, the reduced cost of care to a nursing home for one FIM point is -$.50 per day. In the John Knox study (see "Case Study: Pumping Iron at John Knox Village"), the 19 residents involved in strength training made an 11-point gain on FIM scores, translating to a $104.50 per day reduced burden of care and an annual savings of $38,142.50.

"There is almost a societal attitude in this country that, as people get older, they should be more inactive--they should retire and hit the rocking chair," says Richards. "In cultures where elders remain active we don't see the same kind of strength and functional declines. If osteoporosis is considered a disease process, with billions of dollars spent to treat and research it, muscle weakness should be as well. Osteoporosis substantially affects roughly 20% of the population, whereas muscle weakness affects virtually all seniors. So why shouldn't we give seniors the opportunity to strengthen and become healthier?"

RELATED ARTICLE: Case Study: Pumping Iron at John Knox Village

A study at John Knox Village in Orange City, Florida, involved 19 residents with a mean age of 88 years. In a 14-week, twice-weekly course of therapist-assisted strength building resembling Aegis Therapies' "Freedom through Functionality" program, residents performed 8 to 12 repetitions of one set of exercises on each of the following five Nautilus machines geared toward function-related outcomes:

1. Leg press -- involving quadriceps, hamstrings, and gluteus maximus muscles, used for moving between seated and standing positions.

2. Low-back machine -- isolating the trunk extensor muscles to strengthen the erector spinae muscles that improve posture and the ability to sit on the edge of the bed or the commode.

3. Triceps press -- targeting upper body pushing muscles to aid in rising from a wheelchair.

4. Compound row machine -- addressing upper body pulling muscles and shoulder retraction muscles of the upper back to improve posture, and thus breathing, and straighten rounded shoulders.

5. Four-way neck machine -- facilitating neck extensions and neck flexions to help patients turn their heads and hold them erect, which assists in breathing, drinking, and swallowing.

The following results were reported:

* 3.8% increase in lean body weight, which translates into increased muscle tissue

* 9.7% reduction in body fat

* 9.8% decrease in fat weight

* 81.2% increase in strength from using the leg press

* 38.8% increase in strength on the triceps press

* 9.0% increase in shoulder range of motion

* 14.0% improvement in the FIM score (11-point increase)

The study reported these improvements:

* Improved body composition

* Increased muscle strength

* Enhanced joint flexibility

* Increased functional capacity

* Improved mobility

Medical staff and residents reported further possibilities:

* Increased potential for patient independence

* Improved cooperation between caregivers and patients

* Improved cooperation among nurses, therapists, and recreation specialists

* Enhanced potential for recruiting new residents

* Enhanced potential for recruiting new professional staff

* Reduced healthcare costs

RELATED ARTICLE: QI Contributions

Strength training contributes to the following quality indicators (QIs):

* Falls -- increases balance.

* Depression -- enhances mood. A study published in January 1997 in The Journal of Gerontology shows that strength building alone was as effective as antidepressant medication in reversing depression.

* Bowel and Bladder -- increases strength in the legs and the pelvic floor, with a positive influence on incontinence.

* Feeding Tubes – improves neck strength to enhance swallowing and feeding.

* ADLs -- increases strength, enabling residents to improve dressing and feeding skills.

* Range of Motion -- increases range of motion.

# Prescribing Exercise for Frail Elders

*John M. Heath, MD, and Marian R. Stuart, PhD*

***Background:*** **Frail elders often have chronic illnesses, such as osteoarthritis, hypertension, diabetes, and peripheral vascular disease, for which exercise is a proven means of achieving nonpharmacologic benefits, even at advanced age. Exercise has been shown to enhance the quality of life for these elders.**

***Methods:*** **A literature search of exercise literature applied to older adults and lifestyle modifications was conducted, summarized, and then reviewed with practicing colleagues.**

***Results and Conclusions:*** **Exercise continues to be an underused therapeutic intervention for frail elders as a result of barriers created by patients themselves, their caregivers, and their health care providers. Family physicians can overcome these barriers by prescribing appropriate exercises and by tailoring the exercise to the functional needs and preferences of their patients. An exercise prescription for frail elders is based on a pragmatic strategy that makes therapeutic exercise both sustainable and safe. Such a strategy incorporates motivational elements and knowledge of achievable benefits. (J Am Board Fam Pract 2002;15:218–28.)**

This article reviews why exercise should be considered for frail elders both as a general lifestyle enhancement and as a targeted disease state intervention and suggests strategies for family physicians to increase the exercise activities of their patients.

Inactivity increases with aging. Although about one half of the overall population reports doing some routine exercise activities, only 30% of those aged 65 and older report any regular exercise.[1] This inactivity is in stark contrast to current recommendations of 30 minutes of activity on most days of the week.[2] Exercise encouragement was an important element of *Healthy People 2000*,[3] which sought to enhance public health awareness. A target goal of the initiative was that 50% of primary care providers counsel all their patients on exercise. This issue is not only important for young elders, it also applies to frail elders for whom dramatic changes in outcome measures have resulted from exercise interventions even at advanced age. These benefits include the direct measures of enhanced muscle mass, cardiovascular endurance, and bone density changes, and such indirect measures as greater mobility and safety, which are critical to functional independence.[4]

In addition to its potential for improving general measures of health, exercise can be a specific therapeutic intervention for the many accumulated chronic illness of frail elders. These diseases include osteoarthritis, diabetes, peripheral vascular diseases, coronary heart disease and congestive heart failure, obesity, and depression.[5] Targeted exercise interventions for such conditions are commonly recommended for the affected younger patient populations and should also be considered for frail elderly patients.

Although there has been a shift from viewing exercise as the purview of fit athletes and those participating in organized sports toward its use in achieving improved health and well-being for everyone, family physicians will encounter several barriers to motivating frail elders to exercise. These patients' overall level of functioning has decreased as the result of one or more chronic conditions, and exercise is seldom considered either by the older adults themselves or by their health care providers.[5] Barriers to exercise for this patient population include a lack of knowledge about the documented benefits of exercise in older patient populations, attitudes about the appropriateness of physical exercise for older adults, and environmental factors that do not encourage exercise.[6] Understanding and responding to overcome those barriers are key

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to mobilizing these elderly patients.[7] Family physicians then have to assess their patients' capabilities for exercise and help develop corresponding exercise regimens that their patients will be motivated to undertake.

## Methods

A detailed literature search of multiple databases was conducted using key words such as "exercise benefits," "exercise motivation," "lifestyle modification," and "frail elderly." The results were summarized, and then reviewed for clinical relevancy and practical implementation with a group of practicing clinicians caring for frail older adults in multiple settings.

## Benefits of Exercise for Frail Elders

Many studies have examined the benefits of exercise in frail elders living in skilled nursing facilities, where it is convenient to conduct and assess the effect of group-centered interventions.[8–11] These institutionalized populations, who often have varying degrees of cognitive impairment, can be challenging both when trying to establish motivation for exercise and when creating opportunities for group reinforcement and participation. Study variables on which exercise interventions have had an impact include those directly related to the exercise itself—changes in mobility or strength. More indirect but perhaps more functionally relevant benefits also accrue from exercise, such as improved sleep, physical function, and overall well-being of the participants.[12]

One major intervention study used daytime arm and leg exercises, conducted in a supervised group setting, as a means to improve the sleep of nursing home residents. The investigators found that participants' quality and quantity of sleep improved by about 40% during subsequent nighttime observations.[13] Another institutionally based study examined the effect of weight-training on strength and stair climbing in a selected group of very old (mean age 87 years) nursing home residents.[14] Participants assigned to the intervention group had enhanced overall mobility compared with the control group, for whom only a socialization intervention was provided. This study provides the best evidence that exercise can produce short-term, highly relevant improvements for even the oldest frail elder. In another group of nursing home patients for whom stair climbing was considered well beyond their functional capacity, a structured strength-training program using resistance exercise of upper extremities dramatically improved spontaneous activity.[15]

### *Exercise Benefits Noninstitutionalized Frail Elders*

Although some of the same outcomes for institutionalized frail elders have been found in studies of exercise in community-based frail elders—notably improved sleep derived from a modest aerobic exercise routine[16]—many more exercise studies reporting effectiveness have centered on disease states. Osteoarthritis is a major morbidity factor for frail elders for which exercise is a specific therapeutic intervention.[17] Exercise intervention trials for knee osteoarthritis have shown significant reductions in disability using resistance training that focused on increasing muscle strength and modest aerobic exercise that centered on motion.[18,19] The positive effects of either exercise modality speaks to the positive effects that any form of exercise can have if sustained even for a relatively short time. Specifically, for underlying conditions such as osteoarthritis, increased mobilization of the affected joints, when done in a safe manner, has resulted in the same pain reduction and enhanced mobility as has physical hydrotherapy.[20]

The FAST study—Fitness and Seniors Trial—was a landmark study examining the effects of three forms of exercise intervention compared with a sedentary intervention for four groups of older adults with osteoarthritis.[21] An important feature of this study, which examined pain and disability as well as radiographic changes, was its 18 months' duration. No form of exercise was clearly superior, but when compared with the sedentary group, all exercise groups did show strong improvements to their well-being and in their arthritis outcome markers. An important message from this study was that any form of exercise—general aerobic activities, muscle strengthening using resistance training, range-of-motion activities focused across an affected arthritic joint—can produce important therapeutic benefits in an elderly population. The particular form of exercise in arthritis patients appears less important than that exercise has occurred.

### *Preventing Falls and Their Sequelae*

Exercise is highly relevant to prevention of falls among frail community-dwelling elders. A collab-

orative intervention study, Frailty and Injuries: Cooperative Studies of Intervention Techniques or FICSIT,[23] was developed in an attempt to assess the impact of exercise in reducing falls. Many of the eight clinical FICSIT trials assessed the efficacy and feasibility of exercise intervention strategies, including exercise and balance training, for noninstitutionalized elders through either home-based or group-supervised exercise. Collectively the FICSIT trials were successful in achieving significant reductions in the incidence of falls.[23] Incorporating specific balance training into fall-prevention exercises was believed to be important. Tai chi, a popular Asian mode of exercise that emphasizes balance as well as psychological and spiritual factors, has been studied as a particularly successful strategy for fall prevention. In addition to reducing the frequency of falling, participants in tai chi programs enhanced their lower extremity strength, increased their overall physical activities, and had positive cardiovascular responses.[24,25] Greater daily mobility could be critical for the prevention of future falls, and increasing activities requiring some degree of mobility is an important lifestyle modification to enhance the health and well-being of frail elders.[26]

Strengthening the quadriceps might also be important in reducing the number of falls.[27] Even in 90-year-old participants, resistance training leads to enhanced muscle mass, doubling of strength, and greater independence in activities of daily living. It has been suggested that the benefits of exercise in fall prevention might be related in part to enhanced proprioception in the lower extremities, which has been found to occur after an exercise regimen.[28]

The previous discussion has focused on the physical benefits of exercise that are directly relevant for older frail patients. The many physiologic advantages of preventing cardiovascular disease, reducing insulin resistance, reducing blood pressure, and improving hyperlipidemia in the general population can also benefit frail elders.[29,30] Most medical conditions, however, are treated with pharmacotherapy for maximal improvement. Interventions directed toward improving functional capabilities, such as avoiding falls or increasing upper extremity range of motion (which enhances dressing and bathing), would have a more direct impact on the daily well-being of frail elders. Studies showing that exercise reduces disability in this target population are limited, in part because of the short duration of most intervention trials, and in part because of the need to address environmental and psychological factors that, when combined with physical health, determine disability.[31]

***Psychological Benefits from Exercise***

Regular exercise has been shown to provide such psychological benefits as preserving cognitive function, alleviating depression, and improving a sense of personal control and self-efficacy.[32] Studies in older adults have found psychological benefits from exercise at a variety of intensity levels and settings.[33] Both high-intensity and moderate intensity strength training have been shown to improve mood significantly and reduce symptoms of anxiety.[34] Whereas exercise improves functional fitness (flexibility, coordination, agility, strength and endurance, and cardiorespiratory endurance) and overall psychological well-being, in a randomized controlled trial of 124 community-living postmenopausal women, exercise was shown specifically to lower the intensity of back pain.[35]

In a randomized controlled study of major depression in 156 older patients, 16 weeks of exercise treatment was as effective in relieving symptoms as was treatment with antidepressants.[36] In a careful follow-up study, patients who were exercising had a relapse rate that was significantly less than for patients receiving medication with the exercise intervention.[37] The implication from this study, which advocates the integrative treatment of geriatric depression, is that symptomatic improvement in depression can be enhanced through exercise. Exercise-enhanced improvement in quality of life also occurs in normal states of psychological health in which exercise and leisure activity are predictive of perceived better health and greater life satisfaction.[38]

***Therapeutic Benefits from Low-Intensity Exercise***

A common misconception is that exercise must be performed at high intensity for therapeutic benefit.[12] Although a substantial body of literature has been written on the intensity of aerobic activity and the corresponding degree of fitness, this approach to exercise does not apply to outcomes of greatest relevance to frail elders. A sedentary older person need not achieve an arbitrary degree of oxygen consumption to improve standing ability from a lower leg-strengthening exercise. The resting heart rate does not need to be elevated for a bed-bound frail nursing home patient to improve dressing and

bathing abilities from a range-of-motion and stretching routine. Even for the noninstitutionalized, ambulatory elder who wishes to begin an aerobic exercise program to improve cardiovascular conditioning, the intensity of the exercise program should focus on long-term sustainability and enjoyment to achieve an optimal overall outcome.[39]

## Appropriateness of Exercise for Frail Elders

Health concerns were the most common barrier to regular exercise in studies examining the reasons older adults do not engage in more physical activities.[40,41] This finding underscores the importance of family physicians' promoting appropriate exercise as beneficial rather than as potentially harmful. This personal interaction between physician and patient is distinct from public health concerns for greater overall exercise participation of the population.

The older frail population is predominately female. For older frail female patients, another barrier about exercise is the attitude that women do not exercise.[42] Expectations for physical exertion for women were in transition during the mid 20th century, and the considerable gap between organized sports available to men compared with women is only now being narrowed. Widespread growth in individual fitness activities for women, such as organized aerobic classes, occurred during the late 1960s and early 1970s.[43] As studies have shown, muscle strength in women is related to physical activity in earlier life, and the greater levels of physical fitness and routine exercise enjoyed currently by aging cohorts of women will be helpful in the future.[44]

An ageist attitude that frail elders either cannot be trained or would not want to exercise is not justified. The documented gains in both strength and endurance during short-term intervention trials have repeatedly proved that those who are in their 70s and 80s can achieve benefits from physical training. In a controlled study of home-based strengthening exercises, positive outcome measures included both the expected enhanced muscular strength and increased confidence in movement.[45] Establishing a positive attitude toward physical activity for older frail elders might help them derive ultimate benefit from exercise. Most studies examining how accurately health care providers predict their frail elders' values and attitudes toward health have shown dismal results; physicians tend to underestimate their patients' sense of self-worth and preserved life meaning.[46,47]

Another important, often-cited barrier is the limited success health care providers anticipate when promoting lifestyle changes such as exercise. This expectation is partly because health promotion activities have a delayed impact in the elderly. A Finnish study examining exercise motivations for community-dwelling seniors found that health promotion was the single, most often cited reason for continuing participation in physical exercise 8 years later.[48] Even in the shorter term, physicians can effect positive change in their patient's level of physical activity. In a controlled trial, 225 sedentary adults from 17 physicians' office practices responded to a brief (3- to 5-minute) physician-delivered exercise intervention, combined with a follow-up telephone call reinforcing the exercise message, by significantly increasing their rates of walking.[49] Attitudinal research among elders outside health care settings has found that older adults see physical fitness as a way of achieving their desired functional independence.[50]

Physicians can support patients who are starting exercise efforts, and they can apply the stages of change model described below to counsel other patients who are not yet considering exercise. Such a strategy might be especially effective in overcoming attitudinal barriers when personalized exercise advocated by health professionals is supported by and consistent with the broader public health messages promoting exercise. Even the increased mobility achieved by institutionalized frail elders who have received simple exercise interventions can enhance their quality of life.[51]

## Exercise Environments for Frail Elders

Limited equipment and exercise space are often-cited reasons for not exercising by some patients, both old and young. Other common barriers include competing time demands from other activities (which frequently can involve caring for another, frailer adult), lack of a safe place to exercise, self-consciousness about physical appearance, fear of injury, and the lack of a partner. Many issues cited by older adults were classified as external factors in a British study examining lifestyle changes.[52] Participants at the start of the study were asked to list perceived barriers that prevented

them from adopting an exercise routine. These barriers were then classified as either internal factors, issues relating to their own feelings or attitudes, or external barriers such as those cited above. In the follow-up survey, the older adults who made the greatest changes in incorporating routine exercise into their lives were those who had reported external factors as barriers. The implication from this and other studies is that it is easier for older adults to overcome environmental barriers than to overcome will power barriers to exercise.[53]

When responding to environmental barriers raised by patients, it is important that physicians advocate adapting the exercise to the setting and the time of day the older adult wants to exercise. There will be frail elders who have the requisite mobility, financial resources, and motivation to go to an exercise facility, and gyms and athletic clubs are required by law to accommodate the physical limitations of their membership. For most frail elders, however, exercise needs to take place in the home, senior center, place of worship, or institutional living setting. The latter includes both traditional skilled nursing homes and assisted living or other congregate housing. Many assisted and communal living facilities have dedicated common spaces for exercise activities and have made great efforts to integrate exercise into their residents' daily routine. Physician advocacy can support these efforts and promote accommodation of a variety of exercises. A key element of organized exercise classes is the opportunity for socialization, which is considered to be important for older patients to sustain exercise participation.[54]

## Exercise Participation Assessment

There are few absolute contraindications for exercise by frail elders. Chief among these contraindications is severe heart disease, such as unstable coronary artery disease or recent myocardial infarction, congestive heart failure that has progressed to dyspnea at rest, tachyarrhythmias induced by activity, and critical aortic stenosis.[55] Any condition that becomes symptomatic with minimal activity beyond the routine activities of daily living would preclude meaningful exercise. It is important, however, to recognize that with less advanced disease, exercise can provide dramatic benefits for most patients with heart disease. In fact, exercise can be beneficial both for increasing self-assurance and confidence and for improving cardiovascular parameters. Noncardiac limitations to starting physical exercise include the immediate hypoxic period after a pulmonary emboli, retinal detachment, and unstable cervical spinal conditions.[55]

### *Minimizing Risk*

The more common concerns for family physicians when recommending exercise arise from the need to assess cardiovascular risks induced by exertion. Graded exercise stress testing is the standard approach to younger patients who have cardiovascular risk factors, such as diabetes or hypertension.[56] Recent guidelines suggest that for patients planning low-intensity exercise—heart rates remain below 60% of the predicted maximal rate (220 beats per minute minus the patient's age)—the physician can use clinical judgment to recommend an exercise stress test.[4] When a patient starts exercising, which for most frail elders will focus on strengthening or range-of-motion stretching, monitoring for early adverse symptoms can serve as a stress test. The level of exertion observed by both patient and caregivers might be the best way to assess initial exercise intensity during this period. It is especially important to avoid exhaustion, which is a negative reinforcement to exercise.

After an exercise regimen has been incorporated into the patient's routine, heart rate monitoring can provide the patient and involved caregivers feedback about exercise intensity. In the absence of cardiac or respiratory symptoms, a maximum heart rate of 60% to 75% of the predicted maximum heart rate should be set as a ceiling. Any exercise intensity that increases the baseline resting heart rate is desirable. For older patients who want more sustained aerobic forms of exercise and who can monitor their pulse rate, formal stress testing might be appropriate after an exercise routine has been established and increased intensity has been proposed.[54]

Table 1 lists safety concerns associated with other diseases and conditions commonly encountered in the frail elderly population for whom exercise should be considered.

### *Cognitive Impairment and Exercise*

For many frail elders living in institutional settings, cognitive impairment, such as Alzheimer disease, is a major factor contributing to their frailty. Although the impaired memory, judgment, and in-

**Table 1. Common Medical Limitations for Exercise by Frail Elders.**

| Limitation | Recommended Management |
|---|---|
| Heart disease | Electronic heart rate monitoring (by self or supervisor) |
| | Clearly established initial goals (eg, mobility over fitness) |
| | Availability of nitrates |
| Chronic respiratory condition | Oximetry monitoring |
| | Adequate oxygen tubing length, comfortable mask or cannula |
| Cognitive impairment | Supervision of mobility |
| | Limited concurrent sensory input during exercise |
| Diabetes | Consistent use of insulin injection sites |
| | Pre- and post-exercise home glucose monitoring |
| | Availability of hypoglycemic corrective measures |
| Osteoarthritis | Strength training along functional planes of motion, (avoiding rotational stresses) |
| | Reduce weight-bearing loads |
| | Pre- and post-exercise hot or cold packs to affected joints |
| Sensory impairment | Consistent use of adaptive devices before start of exercise |
| | Center movement around a fixed reference or support point |
| | Low-frequency musical impulses for rhythmic exercise |

sight associated with such dementias complicate patients' participation in exercise programs, these conditions should not be considered contraindications for participation in supportive and supervised exercise activities. Cognitively impaired persons have been incorporated successfully into facility-based supervised movement and exercise programs with positive outcomes.[3,5]

## Prescribing Exercise for Frail Elders

The traditional elements of an exercise prescription can be applied to frail elders: mode of exercise, intensity of exercise, and frequency of exercise.[15] A fourth element—progression—is often included but is less important in those for whom the primary goal is not aerobic fitness. Likewise, exercise intensity might focus on establishing an upper level of endurance rather than a specific threshold.

The variety of exercise modes appropriate for frail elders depends on preserved functional skills, available resources, and perhaps most importantly, those forms of exercise that offer the most enjoyment and can be sustained. Pain-free range of motion is key to all three factors. If whole body movement is not possible initially, the patient should start with isolated upper and lower extremity movements from a stationary position. There is no compelling evidence that endurance exercises (eg, aerobic activities) are better than resistance training (eg, weights) for elderly patients, so a combination of approaches can be appropriate.

There are documented benefits from having the mode of exercise incorporate movement for balance and flexibility, both of which are major factors in fall prevention.[45] Once aerobic movement is established and becomes routine, increasing the intensity by adding various forms of resistance training can increase the strength of the involved muscle groups. Resistance training can include elastic bands of various tensile strengths, as well as the more typical metal dumbbells or plastic-formed weights filled with sand or water. Using weights in the form of hand-held drinking bottles filled with water can provide a motivation for continued hydration, which is important with outdoors exercise.

The initial frequency of an exercise routine for frail elders can be as short as 6 minutes, repeated throughout day. Whereas younger and more mobile patients might consider exercise as a single defined event, shorter and more frequent exercise periods might be more feasible for frail elders, whose schedules often allow more flexibility. Daily, specific exercise periods promote optimum sustainability, although documented benefits in frail elders have resulted from as little as 30 cumulative minutes of exercise a week. Exercise as a group activity encourages both socialization and peer reinforcement.[38]

When family physicians discuss the various modes of exercise for their frail elderly patient, it is important to address explicitly the pleasurable aspects of an exercise to help make it sustainable.

**Table 2. Linking Potential Exercise Modes with Relevant Functional Limitations for Frail Elders.**

| Functional Limitation | Precautions and Exercise Modes |
|---|---|
| *Basic activities of daily living* | |
| Mobility and transferring | |
| Walker use | Chair arms available for seated resistance training |
| | Ensuring secure match between walker tips and floor surface for walking |
| Wheelchair use | Truncal and upper body motion and resistance training |
| Dressing and bathing | |
| Shoulder range of motion restricted | Pre exercise local heat and active stretching |
| Truncal motion limited | Seated, non-weight-bearing rotational motion |
| Continence and toileting | Prompted voiding before and after exercise |
| | Bladder-strengthening exercise (eg, Kegel exercises) |
| | Vaginal weights for enhanced pubococcygeal muscle tone |
| Feeding | Prompted fluids during and after exercise session |
| *Instrumental activities of daily living* | |
| Communication | Proactive postexercise interview and assessment |
| Medication management | Time dosing of selected agents (eg, diuretic medications) |
| Transportation | In-home mobility and strengthening options |
| Shopping and housekeeping | Simple footwear and loose clothing requirements |

Pleasure can be derived from the environment in which the exercise will be conducted (eg, access to music, companionship, etc). Exercise can be integrated into a daily routine by proactively eliminating barriers to activities of daily living (eg, having a toilet available, creating a safe walking environment). Further examples of exercise modes appear in Table 2 and in the discussion of specific disease states and functional limitations.

Table 3 provides an outline of suggested exercise prescriptions adapted for a frail elderly population. Although a written prescription of physician recommendations might reinforce adherence, it alone is unlikely to effect change without the accompanying personal involvement of the patient's own caregivers and other health care providers. Table 4 provides some guidance to support prescribing exercise.

## Specific Conditions Requiring Special Consideration

Chronic obstructive pulmonary diseases, such as chronic bronchitis and emphysema, are common conditions for which exercising specific breathing musculature and general skeletal muscles can result in major improvements in disease status. The limiting factor of breathlessness might require that oxygen desaturation be monitored during activity. Pulse oximeters attached to the finger tip can

**Table 3. Components of an Exercise Prescription for Frail Elders.**

| Exercise Component | Examples |
|---|---|
| Intent: this exercise program will help my . . . . | Circulation problems, heart condition, breathing condition, diabetic glucose control, arthritis, etc |
| Exercise type (mode): I agree to start this type of exercise | Strengthening arm and leg muscles<br>Walking<br>Balance practices<br>Stretching neck and back muscles, etc |
| Dose (endurance): I agree to try this amount of exercise | 10 minutes each session. I breath comfortably from my mouth, my heart rate reaches about __ beats per minute, my oxygen saturation level is at __ |
| Frequency: I agree to try to do this exercise this often | Every morning at breakfast, every time my aide comes, before my nightly dessert, before my bath, during my favorite radio or TV show, etc |

**Table 4. Ways to Encourage and Reinforce Exercise for Frail Elderly Patients.**

| Recommendation | Example |
|---|---|
| Make it fun | Add music and movement to exercise environment |
| | Link exercise to other pleasurable or positive events, eg, favorite radio or television show, pre bath activity |
| Make it social | Promote exercise in groups whenever possible; if not possible, create virtual groups using videotapes |
| | Seek out an exercise partner for mutual support and encouragement |
| Make it sustainable | Advocate for affordable exercise modes |
| | Advocate for brief, dedicated time period(s) for exercise daily |
| Make it a priority | Explicitly validate exercise as a prescribed health intervention |
| | Enlist reinforcement from other health care providers and from family or caregivers |

record heart rate as well as measure the level of oxygen saturation. Having supplemental oxygen available where the patient will be exercising is also recommended.

Patients who have ischemic heart disease also can benefit from breathlessness assessment by monitoring oxygen levels at the start of routine exercise activities. In addition, nitrates in either spray form or sublingual tablets should be immediately available. Finally, electronic pulse monitoring, either by the patient or by a supervisor, can ensure that the intensity of exercise does not result in excess tachycardia.

Diabetic patients who require insulin need to be aware of the potential for hypoglycemia during exercise training and during the hours after cessation of exercise. Patients should not exercise if their blood glucose levels exceed 250 to 300 mg/dL, and blood glucose levels should be monitored before and after exercise. High-carbohydrate foods should be available.[59] These patients should wear an identification tag or other means to alert those around them of their diabetic status should they become unresponsive after their exercise period. Diabetic patients with peripheral neuropathy need to take precautions with their footwear during weight-bearing activities. Weight-bearing activities such as treadmill or step exercise are relatively contraindicated, whereas general aerobic activates without weight bearing (eg, rowing, chair-based strengthening) are recommended. Physicians should also consider the temperature of the environment in which diabetic frail elders (and other frail elderly patients) will be exercising. Nursing homes in particular might need to ensure that the room used for exercise not be overly heated to the temperature required for sedentary activities.

Osteoarthritis of knees or hips will benefit most from both resistance and aerobic exercise when the weight-bearing load over the affected joint is reduced and when the range of motion is maintained to avoid painful rotational joint stresses.[60] Exercising in water provides the greatest reduction of weight over the joint, although nonaquatic programs that support the joint against gravity also are helpful. For example, knee resistance exercise might be done while lying on one's side on a padded surface, with the lower leg sliding along the surface. For weight-bearing exercise, wedge insoles or other forms of unloading orthotic devices designed to alter the alignment of stresses on the joint might have a disease-modifying effect for those who have osteoarthritis of the knee.[61] Splints that limit range of motion to specific planes and prevent hyperflexion of an impaired joint can also be used with muscle-strengthening exercises.

## Physician's Role in Motivating Exercise

Given that benefits are possible from exercise and that barriers to exercise can be overcome, how can the family physician motivate their elderly patients to begin exercising? One commonly used technique is to assess their patient's readiness to start exercising according to their stage of change. The transtheoretical model of change postulates there are five distinct cognitive stages that must be resolved when contemplating a change in lifestyle or habit: precontemplation, contemplation, preparation, action, and maintenance. The first step is to determine whether patients have thought about incorporating some form of regular exercise into their lives, ie, whether they have moved from the precontemplative stage to the contemplative stage.[62] Once the decision to exercise has been made, the preparation stage includes planning for the exercise routine, seeking companions, arranging the schedule, and setting a start date. The next stage is

action, in which the patient engages in the new behavior. Finally the maintenance stage guards against relapses and promotes continuation of the activity until it becomes habitual.

### *The Patients' View*

Patients must see the increase in physical activity as both desirable and achievable. Patients must establish their own goals of exercise. Patient goals might be quite different from what the physician expects the patient to gain from exercise. While a physician might advocate exercise to increase energy in a fatigued patient, expending energy to increase energy might not make sense to the patient and therefore not serve as a motivation. An alternative would be to promote exercise benefits by connecting health status improvements to the outcomes the patient wants and that appear to be achievable. Encouraging patients to consider the benefits of exercise when they were younger is helpful.[4]

It is important to enlist the support of all caregivers and encourage others in their exercise environment to support this change enthusiastically. Although peer support might not always be possible for elders living alone, enhanced adherence to exercise schedules occurs when they have partners.[63] Even when the exercise will occur outside a group setting, weekly peer support groups should be encouraged whenever possible. Supportive caregivers, other health care professionals, and others with whom the patient will interact regarding the exercise program need to know about the proposed regimen. Many older adults have a high degree of respect for medical professionals, and one discouraging or disparaging comment about the proposed exercise program from another physician could seriously undermine motivation. Some patients with special needs can benefit from referral to athletic trainers, physical therapists, sport physiologists, or other professionals who can help provide exercise support.

## Conclusions

Although barriers exist, physicians can effectively promote exercise as a therapeutic intervention for their frail elderly patients. It is essential that physicians enthusiastically discuss exercise on a regular basis. Physicians must explore with patients which types of exercise would best fit into their routines and what support is needed to overcome their sedentary lifestyles. The increased vitality, strength, flexibility, balance, and general sense of well-being that can be achieved through this intervention will reward patient and physician alike.

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