

**COP Public Health Needs Paper – Strength Training for Elderly Women**

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The health and well-being of elderly individuals has become a significant focus for many health care providers due to the aging of baby boomers. According to Healthy Aging in Oregon Counties, 2009, “By the year 2040, the population of adults 60-74 years will increase by about 130 percent for the entire state. The number of the population aged 75 years and older will increase by approximately 170 percent.”<sup>1</sup> In the elderly, the development of sarcopenia or loss of lean body mass, frailty, falls and cognitive decline is substantial in this country, leading to the loss of independence, increased morbidity and mortality, and profound economic burden for many due to health care costs.<sup>1,2,3,11,13,14,22</sup> Strength training is a proven means to build muscle mass and increase strength, and many studies have assessed its ability as part of an exercise program to prevent or slow the development of sarcopenia, frailty, and incidence of falls.<sup>2,3,11,13-16,20</sup> There’s also interest in its potential to protect brain function and mass in this sensitive population.<sup>4,19</sup> According to Healthy People 2020, only about 21% of the adult population in the US performs strength training at least twice weekly,<sup>5</sup> with members of the geriatric population, especially women, having much lower numbers – <11%.<sup>6</sup> Increasing lean body mass with the initiation of regular resistance training in this group could have significant health benefits – improved strength and bone density, decreased incidence of falls and frailty, and slowed cognitive decline.<sup>2-4,7,11,12,17,18,21,22</sup> Therefore, educating elderly women on the benefits of strength training and how to incorporate these exercises into a physical activity routine can potentially allow them to live and function independently longer with this lifestyle change.<sup>1,4,7,11,21,22</sup>

My target audience will consist primarily of elderly women  $\geq 65$  years of age who live independently, or with minimal assistance (assisted living) in the Portland community, and are physically and functionally able to perform strength training.<sup>1,6</sup> I chose this population because they can benefit more from the initiation of resistance training than other age groups given common health concerns, and women statistically have lower rates of performing this activity than men.<sup>1,6,9,10</sup> According to 2017 United States Census Bureau data, roughly half of Oregon's population is female and 17% of the state's population is  $\geq 65$  years of age, resulting in an elderly female population of at least 352,000,<sup>8</sup> a sizable number currently. This becomes an even more sobering statistic when projections of the elderly population are considered, along with subsequent disability and rising health care costs.<sup>1,11,22</sup> According to the CDC's *The State of Aging and Health in America 2013*, "Medicare spending is projected to increase from \$555 billion in 2011 to \$903 billion in 2020,"<sup>22</sup> almost doubling in size in less than 10 years. Regarding differences in strength and endurance/stamina between elderly men and women, statistics indicate there are some.<sup>6,22</sup> Amongst Medicare enrollees, the CDC reports a significantly larger percentage of men aged 65 and older are able to complete functional tasks such as lifting 10 pounds, reaching overhead, kneeling, and walking a minimum of 2 blocks in comparison to women.<sup>22</sup> Many of these activities allow individuals to live and function independently; therefore, the focus of my project has potential far-reaching benefits.<sup>1,2,7,11,21,22</sup>

Many define sarcopenia as the loss of lean body mass that occurs with aging or the result of injury, but according to scientific circles, the term means much more.<sup>3,11</sup> It encompasses the consequences of this loss, namely the decreases in strength and overall muscle function that ensue, ultimately altering an individual's functional status.<sup>2,3,11</sup> Therefore, more emphasis should be placed on the loss of muscle function and strength versus physical mass. While muscle mass

in women peaks between the ages of 30-40 with mass and strength declining afterwards, there is some variation in loss based on age.<sup>2,11,12</sup> Per Zembron-Lacny et al, “after 50 years of age, muscle mass is reported to decline at an annual rate of approximately 1 to 2%, but strength declines at 1.5% per year and accelerates to as much as 3% per year after the age of 60.”<sup>11</sup> There are some longitudinal studies that have found even more startling statistics in individuals  $\geq 70$  years of age, with losses in quadriceps strength of 10 to 25% from baseline over a span of 5 years.<sup>2</sup> Because women commonly have less muscle mass than men, losses that do occur over time can have a significant impact on their overall function, and ultimately their ability to live and function independently.<sup>11,13,14</sup> The development of sarcopenia in the elderly is multifactorial – chronic inflammation with the production of cytokines, increased spinal motor neuron apoptosis, decreased protein utilization and growth factor signaling, and increased reactive oxygen species (ROS) all play roles and contribute to the process.<sup>11</sup>

Sarcopenia and subsequent frailty result in increased mortality and morbidity, loss of independence due to falls, and healthcare costs annually in the millions.<sup>2,3,11,13-15,20,22</sup> In fact, elderly adults that are hospitalized after suffering a fall are roughly 6 times more likely to require nursing home or long-term care following discharge than individuals hospitalized for other conditions.<sup>1</sup> Per Healthy Aging in Oregon Counties, 2009, “Between 2002 and 2006, the average cost for fall injury hospitalization among adults 65 years and older in Oregon was \$101 million per year.”<sup>1</sup> Regarding strength training and frailty, most studies have found that the greatest gains in muscle strength following training are witnessed in frail populations vs healthier weight ones,<sup>2,13,14</sup> making it important to identify individuals at risk to attempt prevention. For instance, in a study by Cadore et al, frail elderly patients were assessed while undergoing multiple modes of exercise promoting balance and endurance, but it wasn’t until after resistance training was

initiated that study participants showed noticeable differences in measures of strength – “time-up-and-go test ( $P < 0.05$ ), improved isometric hand grip, hip flexion and knee extension strength, as well as the leg press 1 Repetition Maximum ( $P < 0.01$ ).”<sup>13</sup> A Yamada et al study compared resistance training outcomes in elderly “robust” and frail individuals (grouped by Timed Up and Go/TUG results), and found that while both groups had gains in muscle mass measurements, only the frail group had significant differences following training between pre-and-post TUG ( $P < 0.001$ ) and Functional Reach ( $P < 0.05$ ).<sup>14</sup>

Detecting a strong correlation between strength training and incidence of falls is difficult to navigate in the literature for two reasons. First, most studied exercise programs designed to decrease the incidence of falls in the elderly incorporate multiple types of exercise (balance, stretching, strength, endurance),<sup>2,13,15,16,20</sup> making it difficult to tease-out benefits of specific components. Only a small number of studies have solely assessed resistance training as an intervention. Second, the cause of falls in the elderly is commonly multifactorial,<sup>2</sup> so the addition of a strength training program solely may not significantly decrease the incidence of falls for many. Researchers and professional organizations, such as the American College of Sports Medicine (ACSM), recommend a combination of flexibility, strength, aerobic, and balance training for all older adults to protect against falls, but strength training is a core component.<sup>17</sup> Studies have also shown that exercise routines must be continued for many months to initially show positive changes with any measured outcome and must be maintained long-term for benefits to last.<sup>2,13-16,20</sup>

Other benefits of strength training recognized in studies include its long-proven effects on bone density and more recent findings of slowing or stabilizing cognitive decline in the elderly.<sup>2,4,12,18</sup> A recommendation for women with osteopenia, osteoporosis or compromised bone density is to

regularly engage in weight-bearing and strength training exercises.<sup>2</sup> The positive correlation between muscle mass and bone density is thought to be due to the degree of torque or strain placed on the bones when surrounding muscles contract; therefore, ample lean body mass allows for greater bone density.<sup>18</sup> Frequent muscle contractions and muscle bulk can stimulate osteoblast activity and diminish osteoclast function, decreasing bone resorption.<sup>18</sup> For instance, a 1995 study by Hughes et al found a strong correlation between the development of triceps and hamstring muscle groups in men and women and their subsequent positive effects on both radial and vertebral bone density ( $P < 0.05$ ).<sup>18</sup> Put simply, more muscle mass equals increased bone strength.<sup>18</sup>

Regarding cognitive function in the elderly, many studies have assessed outcomes with aerobic activity, but more recently, researchers have been studying the effects of strength training on the brain. A randomized controlled trial by Best et al studied elderly women who underwent one year of either resistance training or balance-and-toning exercises with pre and post-intervention brain MRI measurements, executive functioning and memory assessments.<sup>4</sup> At the end of the study period, the women in the resistance training group had higher executive function scores ( $P = 0.005$ ), better memory ( $P = 0.002$ ), and blunted cortical white matter atrophy ( $P = 0.009$ ).<sup>4</sup> It has been shown in prior studies that serum homocysteine levels decrease and insulin-like growth factor 1 (IGF-1) levels increase in response to strength training, both of which are considered “neuroprotective” and correlate with a lower risk of diminished cognitive function.<sup>19</sup> This relationship could explain the positive findings in the Best et al study, but is a continued area of research.

The ACSM recommends “performing 8–10 strengthening activities involving the major muscle groups between moderate and vigorous intensity (8–12 repetitions) at least 2 d/wk.”<sup>2</sup> Per

Physical Activity Updated 2018, “A typical routine involves 2 or 3 nonconsecutive days each week, with most routines being completed in 30-60 minutes, including 1 to 3 sets of each exercise with 1-2 minutes of rest between sets.”<sup>17</sup> Strength training can be accomplished in a formal setting, such as in a gym, or at home in combination with activities of daily living – both modes will have beneficial effects.<sup>7,15,17,20,21</sup> Large muscle groups should be targeted for strength exercises and includes the “legs, hips, chest, back, abdomen, shoulders, and arms”<sup>21</sup> per the 2008 Physical Activity Guidelines for Americans. Many strength exercises can also be modified to fit an individual’s situation and function.<sup>7</sup> Lastly, it is recommended to schedule strength training sessions weekly to have the most success, and to keep track of one’s progress in an exercise log.<sup>7,12</sup>

With the aging of baby boomers and rising health care costs, there is increased focus on interventions that will allow elderly individuals to remain healthier and function independently longer.<sup>3,13,14,19</sup> The widespread prevalence and recognition of sarcopenia, with its far-reaching consequences, have made it a popular topic of study for many researchers. To date, the most effective treatment known to slow losses in strength and maintain muscle function is resistance training on a consistent basis.<sup>3,7,12,19</sup> Therefore, a component of weight training should be incorporated into every elderly women’s exercise program to minimize sarcopenia, promote bone density, decrease frailty and chance of falling, and slow cognitive decline.<sup>2-4,11,13-16,19,20</sup>

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