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Original Research

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Intervention for Treating Sarcopenia in Older Residents in a Skilled Nursing Facility

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Abstract

The incidence of sarcopenia, a geriatric syndrome characterized by the progressive and generalized loss of muscle quantity or quality, increases with age and is associated with adverse health and quality of life outcomes. A 12-week strength training intervention program (STIP) was designed to improve measures of muscle mass, muscle strength, physical performance, and quality of life in elderly patients with sarcopenia. Data were collected on these measures at 4-week intervals over 12 weeks. Results showed that the STIP was an effective intervention for reducing the characteristics associated with sarcopenia. Significant gains were made in muscle mass, grip strength, balance, gait speed, chair stand, and quality of life over the 12-week period. Reduction in the incidence of sarcopenia among long-term care residents in skilled nursing facilities may contribute to reduced adverse effects of the disease process, such as falls, morbidity, and mortality, and may help residents achieve an overall higher quality of life.

Keywords: *sarcopenia, strength training, intervention, quality of life*

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Introduction

Sarcopenia is a well-known geriatric syndrome, characterized by the progressive and generalized loss of muscle quantity or quality (Cruz-Jentoft et al., 2019). Rosenberg (1997) first coined the term in 1988 to generate

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interest in more extensive clinical exploration of the phenomenon. Although sarcopenia is typically a function of old age, it may be mediated by behavioral and emotional factors such as fatigue, sleep, depression, and self-efficacy (Brady et al., 2014). The incidence of sarcopenia increases with age (Cruz-Jentoft et al., 2019) and has been associated with adverse outcomes such as increased risk of falls (Bischoff-Ferrari et al., 2015; Schaap et al., 2017), cognitive impairment (Chang et al., 2016), loss of independence (dos Santos et al., 2017), diminished quality of life (Barthalos et al., 2016; Olsen et al., 2019), increased health costs (Akune et al., 2014), need for care in a long-term facility (Akune et al., 2014), and increased mortality (Batsis et al., 2014; De Buyser et al., 2016). Physical activity has been the most prevalent recommendation for treating (Dent et al., 2018) and preventing (Steffl et al., 2017) sarcopenia. However, not all residents in long-term care or skilled nursing facilities are screened for sarcopenia or provided the opportunity to engage in regular physical exercise.

At the second meeting of the European Working Group on Sarcopenia in Older People (EWGSOP2), low muscle strength was identified as a probable indicator of sarcopenia (Cruz-Jentoft et al., 2019). According to EWGSOP2, “A sarcopenia diagnosis is confirmed by the presence of low muscle quantity or quality; [and] when low muscle strength, low muscle quantity/quality and low physical performance are all detected, sarcopenia is considered severe” (Cruz-Jentoft et al., 2019, p. 18). These definitions have been accepted by a number of international scientific societies and are the most widely cited definitions of sarcopenia (Cruz-Jentoft & Sayer, 2019).

The prevalence of sarcopenia can be determined in multiple ways, including the use of biochemical markers (Tosato et al., 2017) and diagnostic imaging to measure muscle mass (Cruz-Jentoft & Sayer, 2019) and the use of dynamometry to measure grip strength (Beaudart et al., 2019). Gait speed also can be used as a physical diagnostic of lower-limb muscle strength (Beaudart et al., 2019; Dent et al., 2018). Additionally, various patient-reported outcome tools are available for collecting self-reported data, including the Sarcopenia and Quality of Life questionnaire (SarQoL), used to measure the quality of life of patients with sarcopenia (Beaudart et al., 2015a, 2015b), and the SARC-F (Strength, Assistance walking, Rise from chair, Climb stairs, and Falls) questionnaire, used to identify probable sarcopenic individuals (Malmstrom et al., 2016). Although some measurement tools used in practice have not demonstrated good validity (Bruyère et al., 2016), results of psychometric testing have shown the SarQoL is both a valid and reliable instrument (Malmstrom et al., 2016). The SARC-F, which has been endorsed as an international clinical practice for diagnosing sarcopenia (Dent et al., 2018), also has demonstrated good validity and reliability (Beaudart, Biver, et al., 2017).

As of 2022, there were no federally approved drugs for the treatment of sarcopenia, although 10 pharmacological treatments have been suggested, including vitamin D and a variety of hormone therapies among others (Cruz-Jentoft & Sayer, 2019). Physical activity, however, has been the most frequent recommendation for treating (Dent et al., 2018) and preventing (Steffl et al., 2017) sarcopenia. While the international clinical practice guidelines for sarcopenia specifically recommended resistance-based physical activity (Dent et al., 2018), in a systematic review of the association between physical activity and sarcopenia, several types of physical activity resulted in decreased incidents of sarcopenia (Steffl et al., 2017).

Purpose of the Study

Although prevalence rates vary, it is clear that the incidence of sarcopenia increases with long-term survival, as is the case with patients in end-of-life care (Henwood et al., 2017) and residents in long-term care facilities (Cruz-Jentoft & Sayer, 2019). As already noted, physical activity has been the most prevalent recommendation for treating (Dent et al., 2018) and preventing (Steffl et al., 2017) sarcopenia. Our purpose was to determine if strength training, one form of physical activity, is an effective intervention for treating sarcopenia, as measured by muscle mass, muscle strength (i.e., grip strength), physical performance (i.e., balance, gait speed, and chair stand), and overall quality of life among older adults in a skilled nursing facility.

Methods

Stetler et al.'s (2011) revised Promoting Action on Research Implementation in Health Services (PARIHS) framework was used to guide the development and implementation of an evidence-based intervention intended to decrease the incidence of sarcopenia in older patients in a skilled nursing facility. The PARIHS framework is an explanatory framework (Stetler et al., 2011) developed to provide an understanding of the elements that contribute to the successful implementation of research into practice in the healthcare setting (Kitson et al., 1998). The application of the PARIHS framework for the design of the strength training intervention program (STIP) is displayed in the Appendix.

Research Design

We conducted an evidence-based study using a one-group pretest-posttest design. We used a small sample without a control group or subject randomization. Participants' muscle mass, muscle strength, physical performance, and overall quality of life were measured at baseline (before intervention) and after 4 weeks, 8 weeks, and 12 weeks of participation in the program.

Ethical Considerations

The research was reviewed and approved by Florida Southern College's Institutional Review Board. Participants were made aware of the details of the research through informed consent. Participation was voluntary. The research was conducted in accordance with recognized ethical standards.

Setting

The research site, located in Florida, is a 120-bed skilled nursing and rehabilitation facility that offers therapeutic and rehabilitation services, including physical therapy, occupational therapy, and speech therapy, to patients 25 years of age and older. Care is available on an outpatient, short-term inpatient, or long-term inpatient basis.

Sample and Recruitment

We used a convenience sample of older residents from the skilled nursing facility. There were four inclusion criteria: (a) long-term residency, (b) 65 years of age or older, (c) English fluency, and (d) a score of 4 or more on the SARC-F. To ensure participants would complete the 12-week program, only long-term residents were considered for participation. English language fluency was a necessary inclusion criterion because participants had to understand the expectations for participation in the research and the procedures for the exercise program. A score of 4 or more on the SARC-F was necessary because that score range indicates the presence of sarcopenia.

There were three exclusion criteria: (a) cognitive impairment, (b) a physical or health limitation that impedes capacity to engage in moderate exercise, or (c) an active physical therapy order. Residents were excluded if they had a cognitive impairment, in order to ensure that only participants who understood voluntary participation were included in the research and that participants would be able to follow instructions. If residents had an active physical therapy order, they were excluded, because we would not have been able to collect accurate baseline measures or determine whether participant improvements were due to the existing physical therapy or the STIP.

We determined through a review of medical records whether residents met the inclusion criteria and were not eliminated based on the exclusion criteria. Using the internal resident mail system, flyers about the STIP were delivered to eligible residents after physician clearance was given. After 1 week, a reminder flyer was sent to eligible participants who had not already enrolled in the research. The third author screened residents for sarcopenia using a case-finding approach, an appropriate method to use in care settings where one might expect to find a high prevalence of sarcopenia (Cruz-Jentoft & Sayer, 2019). Dent et al.'s (2018) guidelines for diagnosis and screening of sarcopenia were used to identify residents with SARC-F scores of 4 or more. Those individuals were considered to have sarcopenia and were included in the intervention. Of the 30 eligible participants in the skilled nursing facility, 23 residents volunteered.

STIP

The American College of Sports Medicine (ACSM) has suggested that older adults engage in moderate to vigorous resistance exercise at least two times a week and engage in balance exercises as needed to generate improvement (Chodzko-Zajko et al., 2009). Participants exercised two times a week for 12 weeks. The exercises were varied weekly to optimize strength gains (Baz-Valle et al., 2019; Kraemer & Ratamess, 2004) and maintain participant interest. The resistance training and balance exercises followed the descriptions provided in the ACSM's Position Stand "Exercise and Physical Activity for Older Adults" (Chodzko-Zajko et al., 2009).

The resistance exercise portion of the intervention followed the guidelines from the ACSM so that it was a "progressive weight training program … [that included] (8–10 exercises involving the major muscle groups of 8–12 repetitions each), stair climbing, and other strengthening activities that use the major muscle groups" (Chodzko-Zajko et al., 2009, p. 1511). The balance portion of the intervention included

> 1) progressively difficult postures that gradually reduce the base of support (e.g., two-legged stand, semitandem stand, tandem stand, one-legged stand), 2) dynamic movements that perturb the center of gravity (e.g., tandem walk, circle turns), 3) stressing postural muscle groups (e.g., heel stands, toe stands), or 4) reducing sensory input (e.g., standing with eyes closed). (Chodzko-Zajko et al., 2009, p. 1511)

The STIP for this research is provided in Table 1.

Data Collection

Prior to beginning the STIP, participants were assessed to establish they were sarcopenic and eligible for inclusion as well as to establish baseline data. Sarcopenia is indicated when an individual's muscle mass is less than 8.87 kg/m in men and less than 6.42 kg/m in women (Cruz-Jentoft & Sayer, 2019), grip strength is less than 30 kg in men and less than 20 kg in women (Beaudart, Biver, et al., 2017), there are fewer than 8 combined points on the short physical performance battery (SPPB; Guralnik et al., 2000), and a participant's SARC-F score is 4 or more (Malmstrom et al., 2016).

Muscle mass was measured using an Inevifit body-analyzer scale. Grip strength was measured using a Handeful digital strain gauge dynamometer. Grip strength is considered a good proxy measure of muscle strength (Beaudart et al., 2019). Participants' physical performance was measured using the SPPB. The SPPB was developed by the National Institute on Aging (2021) to measure lower extremity function in older persons. The SPPB is made up of the three separate measures of balance, gait speed, and chair stand (Guralnik, 2020) and has been shown to be a valid measure of lower extremity function in the elderly (Guralnik et al., 1994).

Participants' SARC-F scores were calculated from responses to the SARC-F questionnaire, which gathers data about an individual's strength, need for assistance in walking, ability to rise from a chair, ability to climb stairs, and fall history (Malmstrom et al., 2016).

Finally, quality of life data were collected using a paper version of the SarQoL questionnaire. The SarQoL was developed specifically to measure quality of life among elderly people (i.e., people 65 years and older) who live in community settings (Beaudart et al., 2015a). The SarQoL asks 22 questions pertaining to physical and mental health, locomotion, body composition, functionality, activities of daily living, leisure activities, and fears. Scoring for the instrument is based on an algorithm (Beaudart et al., 2015a), and scoring of SarQoL protocols was completed online through the SarQoL website (SarQoL, 2021).

Table 1. *Strength Training Intervention Program (STIP)*

Weeks 1, 4, 7, and 10								
	Week 1		Week 4		Week 7		Week 10	
Band Color[1]	Blue		Yellow		Orange		Orange	
Exercise	Reps	Sets	Reps	Sets	Reps	Sets	Reps	Sets
Upper body								
Chest pull	10	2	12	3	12	3	12	3
Bicep curl	10	2	12	3	12	3	12	3
Lower body								
Seated hip flexion	10	2	12	3	12	3	12	3
Inner thigh stretch	10	2	12	3	12	3	12	3
Abdominal								
Standing side-to-side twist	10	2	12	3	12	3	12	3
Core twist	10	2	12	3	12	3	12	3
Balance								
One-legged stand	5	3	5	3	5	3	5	3
Chair stand	5	3	5	3	5	3	5	3
Weeks 2, 5, 8, and 11								
	Week 2		Week 5		Week 8		Week 11	
Band Color	Blue		Yellow		Orange		Brown	
Exercise	Reps	Sets	Reps	Sets	Reps	Sets	Reps	Sets
Upper body								
Lateral raise	10	3	10	3	10	3	12	3
Chest press	10	3	10	3	10	3	12	3
Lower body								
Toe point/flex	10	2	10	3	10	3	12	3
Leg lift	10	2	10	3	10	3	12	3
Abdominal								
Side-stretching band pull	10	2	10	3	10	3	12	3
Seated crunches	10	2	10	3	10	3	12	3
Balance								
Semitandem stand	5	3	5	3	5	3	5	3
Tandem walk	5	3	5	3	5	3	5	3
Weeks 3, 6, 9, and 12								
	Week 3		Week 6		Week 9		Week 12	
Band Color	Yellow		Orange		Orange		Brown	
Exercise	Reps	Sets	Reps	Sets	Reps	Sets	Reps	Sets
Upper body								
Isometric arm lifts	10	3	10	3	12	3	12	3
Seated chest fly	10	3	10	3	12	3	12	3
Lower body								
Seated foot twists	10	3	10	3	12	3	12	3
Seated front kicks	10	3	10	3	12	3	12	3
Abdominal								
Seated sit-ups	10	3	10	3	12	3	12	3
Seated crunches	10	3	10	3	12	3	12	3
Balance								
Modified forward lunge	10	3	10	3	12	3	12	3
Tandem walk	5	3	5	3	5	3	5	3

[1]Blue band = 6–8 lbs. equivalent resistance, yellow band = 8–10 lbs. equivalent resistance, orange band = 10–12 lbs. equivalent resistance, brown band = 15–20 lbs. equivalent resistance.

Over the course of the STIP, muscle mass, grip strength, balance, gait speed, chair stand, and quality of life were measured at 4-week, 8-week, and 12-week intervals.

Data Analysis

Data collected using the SARC-F questionnaire were used only for screening purposes and were not included in any data analyses. To analyze the remaining data, we used JASP 0.17.1 statistical software. We conducted repeated-measures analysis of variance to evaluate changes in muscle mass, grip strength, balance, gait speed, chair stand, and quality of life after 4, 8, and 12 weeks of the STIP.

Results

There were 23 participants between the ages of 66 and 87 years old, with a mean age of 78.7 years old (*SD* = 6.39). More women (n = 14) than men (n = 9) participated. SARC-F scores ranged from a low of 5 to a high of 10 with a modal score of 9. The mean muscle mass of participants before the intervention was 48.3 kg, and after 12 weeks of intervention, mean muscle increased to 49.5 kg. Mean grip strength before the intervention was 23.0 lbs., and after 12 weeks of intervention, mean grip strength increased to 27.0 lbs. Mean sarcopenia quality of life before intervention was 39.1 on the 0-to-100 scale, whereas after 12 weeks of intervention, sarcopenia quality of life increased to 56.3.

Three measures of lower body extremity function were measured. Before intervention, the modal score for balance was 2 (i.e., individual can hold a semitandem stand for 10 seconds but is unable to hold a full tandem stand for more than 2 seconds), and after 12 weeks of intervention, the modal balance score increased to 4 (i.e., individual can hold the full tandem stand for 10 seconds). Before intervention, the modal score for gait speed was 1 (i.e., individual walks at ≤ 0.43 m/s), and after 12 weeks of intervention, modal gait speed increased to 3 (i.e., individual walks between 0.61–0.77 m/s). Finally, before intervention, the modal score for chair stand was 1 (i.e., individual can stand and sit 5 times requiring > 16.7 seconds) and after 12 weeks of intervention, the modal chair stand increased to 3 (i.e., individual can stand and sit 5 times in 11.2 to 13.6 seconds).

Repeated Measures Analysis of Variance (ANOVA)

Table 2 displays the results of the repeated measures ANOVAs. First, we tested for the assumption of sphericity using Mauchly's test. For muscle mass, grip strength, gait speed, and quality of life, the results of Mauchly's tests were statistically significant. Therefore, to control for inflated Type I error, the Greenhouse-Geisser correction was used for ANOVAs in which the sphericity assumption was not met (i.e., Mauchly's test was statistically significant).

Statistically significant gains were made on all measures (except muscle mass) in only 4 weeks, and statistically significant gains were made on all measures (muscle mass, grip strength, balance, gait speed, chair stand, and quality of life) over the 12-week intervention period. The STIP had the greatest effect on balance, gait speed, chair stand, and quality of life over 12 weeks. On average, participants' balance score preintervention (M = 1.52, *SD* = 0.51) increased over 12 weeks (M = 3.65, *SD* = 0.57) by 2.13, which was statistically significant (F[3,22] = 143.25, p < .001, ω^2 = 0.639). On average, participant's gait speed score preintervention (M = 1.26, *SD* = 0.45) increased over 12 weeks (M = 3.09, *SD* = 0.42) by 1.83, which was statistically significant (F[2.283,22] = 114.57, p < .001, ω^2 = 0.655). On average, participant's chair speed score preintervention (M = 1.22, *SD* = 0.42) increased over 12 weeks (M = 3.09, *SD* = 0.42) by 1.87, which was statistically significant (F[3,22] = 137.35, p < .001, ω^2 = 0.715). On average, participant's quality of life score preintervention (*M* = 39.07, *SD* = 5.91) increased over 12 weeks (*M* = 56.30, *SD* = 5.39) by 17.23, which was statistically significant ($F[2.058,22] = 103.39$, $p < .001$, $\omega^2 = 0.566$).

Table 2. *Results of Repeated Measures Analysis of Variance*

Exercise /	Time 1		Time 2		Bonferroni				Effect
Time Measured	M	SD	M	SD	post hoc *p*	*F* ratio	*df*	*p*	size (ω^2)
Muscle mass[1]									
Baseline	48.32	8.04				6.46	1.443	.009	0.003
4 weeks			48.84	8.00	.487				
8 weeks			49.34	8.00	.006				
12 weeks			49.50	8.05	.001				
Grip strength[2]									
Baseline	23.02	12.19				38.37	1.248	<.001	0.014
4 weeks			24.75	12.35	<.001				
8 weeks			25.16	11.59	<.001				
12 weeks			27.04	11.55	<.001				
Balance[3]									
Baseline	1.52	0.51				143.25	3	<.001	0.639
4 weeks			2.35	0.71	<.001				
8 weeks			2.91	0.52	<.001				
12 weeks			3.65	0.57	<.001				
Gait speed[4]									
Baseline	1.26	0.45				114.57	2.283	<.001	0.655
4 weeks			2.00	0.67	<.001				
8 weeks			2.74	0.45	<.001				
12 weeks			3.09	0.42	<.001				
Chair stand[5]									
Baseline	1.22	0.42				137.35	3	<.001	0.715
4 weeks			1.96	0.56	<.001				
8 weeks			2.78	0.42	<.001				
12 weeks			3.09	0.42	<.001				
Quality of life[6]									
Baseline	39.07	5.91				103.39	2.058	<.001	0.566
4 weeks			45.24	7.37	<.001				
8 weeks			54.03	5.16	<.001				
12 weeks			56.30	5.39	<.001				

[1] $W = .15$, $\chi^2\,(5) = 39.63$, $p < .001$.
[2] $W = .07$, $\chi^2\,(5) = 56.21$, $p < .001$.
[3] $W = .64$, $\chi^2\,(5) = 9.32$, $p = .097$.
[4] $W = .54$, $\chi^2\,(5) = 12.94$, $p = .024$.
[5] $W = .79$, $\chi^2\,(5) = 4.95$, $p = .423$.
[6] $W = .30$, $\chi^2\,(5) = 25.09$, $p < .001$.

Discussion

Overall, the data showed that the STIP was an effective intervention for reducing the characteristics associated with sarcopenia. The resistance training and balance exercises resulted in significant gains in grip strength, balance, gait speed, and chair stand over 4 weeks, and the significant gains continued over the 8- and 12-week intervention periods as well. Significant gains in muscle mass were observed after 8 weeks of the STIP, and gains continued over 12 weeks. The literature supports the use of resistance training for improving muscle mass (Bandeira de Mello et al., 2019; Talar et al., 2021; Vikberg et al., 2019; Zhang et al., 2021), grip strength (Beaudart, Dawson, et al., 2017; Hassan et al., 2016; Liao et al., 2017), balance (Vikberg et al., 2019), gait speed (Beaudart, Dawson, et al., 2017; Liao et al., 2017), and chair stand (Beaudart, Dawson, et al., 2017; Liao et al., 2017). Finally, the data showed steady significant gains in quality of life over the intervention period. After 12 weeks of the STIP, quality of life improved by over 17 scale points on a 0-to-100 scale. The literature supports the finding that resistance training improves quality of life to a moderate degree (Barthalos et al., 2016; Olsen et al., 2019).

Implications for Practice

The results show that all measured components of sarcopenia (i.e., muscle mass, muscle strength, physical performance, and overall quality of life) improved over the course of the intervention. The findings can be used for making informed decisions about integrating a muscle-strengthening exercise intervention into existing care programs. Practitioners in skilled nursing facilities and assisted-living care settings may use these findings as a starting point in the decision-making process when considering options for reducing the incidence of sarcopenia among their long-term care residents. Based on our initial findings, strength training programs have the potential to serve as an effective means for reducing the incidence of sarcopenia among long-term care residents.

Limitations

Although the results indicated that the STIP improved all measured components of sarcopenia, these results need to be interpreted cautiously, because the sample size was small, and the preexperimental pretest–posttest design does not imply causality. Another limitation was that, although appropriate according to the EWGSOP2 guidelines, the body-analyzer scale used to measure muscle mass works using electricity to provide body fat analysis. The use of a more powerful and accurate diagnostic tool, such as a dual-energy X-ray absorptiometry scan (DEXA scan), would have produced more accurate body mass data. Similarly, a hydraulic dynamometer may have provided more accurate grip strength data. Finally, the intervention was limited to a resistance exercise protocol.

Conclusion

The purpose of this study was to determine the efficacy of a strength training program for treating sarcopenia among older adults at a skilled nursing facility. Although the sample size was small, the findings indicated that a strength training program can reduce the incidence of sarcopenia among long-term care residents in skilled nursing facilities. Practitioners in skilled nursing facilities and assisted-living care settings may use the findings from this study to consider whether a similar program might be appropriate for their residents. Reduction in the incidence of sarcopenia among long-term care residents in skilled nursing facilities may, subsequently, contribute to reduced adverse effects of the disease process, such as falls, hospital readmissions, morbidity, and mortality, and may help residents achieve an overall higher quality of life.

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Appendix

Application of the PARIHS Framework (Four Core Elements)

Evidence	Contextual readiness for targeted evidence-based practice implementation	Facilitation	Successful implementation
The third author developed a strength-training intervention following guidelines published by the EWGSOP2 (Cruz-Jentoft et al., 2019) and based on other research published in scholarly peer-reviewed journals (Antoniak & Greig, 2017; Bandeira de Mello et al., 2019; Barthalos et al., 2016; Beaudart, Dawson, et al., 2017; Beckwée et al., 2019; del Campo Cervantes et al., 2019; Hassan et al., 2016; Liao et al., 2017; Lopez et al., 2018; Olsen et al., 2019; Talar et al., 2021; Vikberg et al., 2019; Vlietstra et al., 2018; Zhang et al., 2021). Additionally, as a nurse practitioner, she had observed the positive effects of strength exercises on patients participating in physical therapy. She had conversations with residents at a skilled nursing facility, during which some residents expressed their fear of falling and their dissatisfaction with their quality of life. Also, the cost for the exercise program was minimal, and the program (a) had the potential for promoting valuable change for the residents at the facility, (b) was compatible with the concept of care underlying the facility, and (c) was simple enough for the residents to manage. Finally, the measures used to determine improvement in muscle mass, muscle strength, and physical performance were based on observable actions.	The research site (a skilled nursing facility) has a history of strong leadership that supports a patient-first culture that is open to change. The administration enables and encourages teamwork and collaboration between all staff members, regardless of whether they are employees of the center or other healthcare networks on premises providing patient care. However, staff roles are clearly delineated, and those who initiate change through interventions are held accountable for demonstrating progress and desirable outcomes. The intervention for this research could be objectively evaluated. Although no assessments unique to the skilled nursing facility were used for the intervention, established measures and instruments were used to record data for each of the four focus areas in the program (i.e., muscle mass, muscle strength, physical performance, and overall quality of life). Lastly, the skilled nursing facility had space in which the residents could engage in physical activity, and the intervention was appropriate for the setting.	The change initiated through this intervention was task focused. As a nurse practitioner, the third author was fully capable of facilitating the muscle strengthening intervention with the given population. She was well established among the facility's staff, and the expectations for the intervention were clearly expressed to the facility's administrators.	The third author developed the plan for implementing the strength training program. The plan was based on high quality studies (Antoniak & Greig, 2017; del Campo Cervantes et al., 2019; Hassan et al., 2016; Liao, Tsauo, Lin et al., 2017; Lopez et al., 2018) and recommendations from well-respected organizations in the field (Beaudart et al., 2019; Chodzko-Zajko et al., 2009; Cruz-Jentoft et al., 2019). Appropriate and established measures and instruments were chosen to ensure the accurate recording of data and to improve the validity of the findings. The exercise program was consciously designed with the physical capabilities of the elderly population in mind. Administrators at the skilled nursing facility expressed their belief in the value of this intervention. Because residents of the skilled nursing facility had expressed dissatisfaction with their quality of life, we anticipated that the strength training exercise program would be well-received among the residents.

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