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Exercise Guidelines to Counteract Physical Deconditioning in Long-Term Care Facilities: What to Do and How to Do It?

Eva Peyrusqué PhD(c) [a,b], Fanny Buckinx PhD [a,b], Marie-Jeanne Kergoat MD [b,c], Mylène Aubertin-Leheudre PhD [a,b,*]

[a] *Département des sciences de l'activité physique, Groupe de recherche en activité physique adaptée, Université du Québec à Montréal, Montréal, Québec, Canada*
[b] *Centre de Recherche de l'Institut universitaire de gériatrie de Montréal, Montréal, Québec, Canada*
[c] *Faculté de Médecine, département de médecine, Université de Montréal, Montréal, Québec, Canada*

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ABSTRACT

With age, older adults experience a decrease in muscle function and changes in body composition, which raise the risk of functional incapacity and loss of autonomy. These declines are more pronounced in older adults living in long-term care (LTC) facilities than those living in the community (ie, sarcopenia prevalence: ∼41% vs ∼10%; obesity prevalence: 30% vs17%). The main cause of these declines is chronic diseases, which are a driver of higher rates of sedentary behavior (85% of time in LTC). Exercise, however, is recognized to help counteract age-related decline, yet it is not integrated into clinical practice.

This study reviews the main exercise guidelines and recommendations aiming to maintain physical and functional capacities in the context of long-term care (LTC). Recommendations include completing at least 2 sessions of a minimum of 35 minutes each per week; combining different types of exercises (balance, flexibility, resistance, aerobics, functional exercises) into each session; limiting sedentary time by incorporating brief activities (walking, sit-to-stand challenges, or an active game during a TV commercial break) to break up the day; adapting and personalizing physical activity sessions to the resident's fitness level to ensure safety and encouraging fun and enjoyment during exercise activities (ie, gardening, walking); considering the preferences of the resident, like exercise schedule, type, and modality (group, individual, in person, remote); educating and motivating residents, family members, and the health care team about the health benefits of physical activity and addressing their fears; and involving everyone to integrate physical activity as a long-term habit.

Older adults who can no longer live at home independently are often relocated to LTC facilities. Among the general population, 2.4% of people aged 65 and older and 11% of those aged 85 and older live in LTC. The population in LTC is very heterogeneous and their care is therefore complex. In fact, the greatest challenges for LTC facilities are the quality of care and the prevention of loss of autonomy.

In addition to major neurocognitive disorders, one of the main causes of admission into LTC is changes in physical performance. In this setting, the prevalence of sarcopenia is 31% for men and 51% for women,[1,2] and the prevalence of obesity is 30%.[3] In addition, aging is known to decrease functional performance.[4] All these physical changes lead to the loss of physical autonomy and quality of life, as well as increased mortality.[5-11]

A sedentary lifestyle and physical inactivity are recognized as the main factors leading to age-related decline, chronic disease, and disability. In fact, residents in LTC typically have more than 10 hours of sedentary time/day, excluding sleeping hours.[12] Moreover, more than 30% of LTC residents report decreased physical activity levels since their institutionalization.[13] Overall, 85% of LTC residents' time is sedentary, and very little time is dedicated to physical activity (12% low intensity, 2% light intensity, and 1% moderate-to-vigorous intensity).[14] Therefore, it is important to find solutions to limit sedentary time and physical inactivity in LTC facilities. Thus, the aim of this article was to review existing data on physical activity and provide exercise guidelines in the context of LTC. More specifically, we seek to answer the following: (1) How often older adults living in LTC should practice physical activity? (2) What type of physical activity is most

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* Address correspondence to Mylène Aubertin-Leheudre, PhD, Département des Sciences de l'activité physique, Université du Québec à Montréal (UQAM), Pavillon des sciences biologiques (SB), 4th floor, 141 Président-Kennedy Avenue, SB-4615, Montréal, Québec, Canada H3C 3P8.

E-mail address: aubertin-leheudre.mylene@uqam.ca (Mylène Aubertin-Leheudre).

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Table 1
Characteristics of Physical Activity Studies in LTC Facilities: Aerobic

Author	Country	Participant (Number; Years; % Female)	Type of Intervention	Duration of Intervention	Evaluation	Outcomes	Results
Tappen et al. 2000[15]	USA	N = 65 (84% female) G1: n = 21; 84.3 ± 7.5 y G2: n = 26; 87.4 ± 5.8 y G3: n = 24; 89.6 ± 6.5 y	G1: walk G2: conversation G3: walk + conversation	30 min 3x/wk for 16 wk	Baseline/16 wk	6-min walk and compliance	- 6-min walk test: Distance decreased for G1 (−20.7%) > G2 (−18.8%) > G3 (−2.5%) + group*time interaction effect ($P < .05$). - 6-min walk test: Distance significantly decreased for G2 only ($P = .01$). - Weaker compliance ($P < .0001$): G1 (57%) < G3 (75%) < G2 (90%).
Venturelli et al. 2011[16]	Italy	N = 24 (100% female) G1: n = 12; 83 ± 6 y G2: n = 12; 85 ± 5 y	G1: walk G2: control	30 min walk 4x/wk for 24 wk	Baseline/24 wk	6-min walk, MMSE, ADL (Barthel), compliance	- 6-min walk test: Distance decreased for G2 (−29%) but increased for G1 (+20%) + differences within and between groups ($P < .05$). - ADL: Improvement for G1 (+8 pts; $P < .05$) + difference between groups ($P < .05$). - MMSE score: Decrease for G2 (−6 pts; $P < .05$) + difference between groups ($P < .05$). - Compliance: 93.4%.
Kalu et al. 2021[17]	Canada	N = 168 (n.a% female) G1: n = 57; 82.7 ± 6.7 y G2: n = 55; 82.7 ± 9.3 y G3: n = 56; 85.4 ± 8.8 y	G1: walk G2: conversation with the research staff G3: control	30 min 5x/wk for 16 wk	Baseline/16 wk	GAITrite (walking speed, stride, step length, cadence)	- Walking speed ($P = .0006$): G1 (+0.10 m/s) > G2 (−0.01 m/s) > G3 (−0.02 m/s).

CSA, cross-sectional area; G1, group 1; G2, group 2; G3, group 3; MMSE, Mini-mental state examination; n.a, non-applicable.
Searches for these studies were limited to the 2000s and were conducted in the PUBMED, CINAHL, and Embase databases. This is not a systematic review or meta-analysis.

appropriate in this setting? (3) Which extrinsic or intrinsic factors could support physical activity adherence in LTC settings?

Impact of Physical Activity on Physical Health

See Tables 1−4 for more detail.

Aerobic Physical Activity

A few studies conducting aerobic interventions in LTC have been published (Table 1). Two studies evaluated the effects of a moderate-intensity walking program and observed an improvement in cardiorespiratory capacity, walking speed, and autonomy [activities of daily living (ADLs)].[16,17] Another study showed that only 30 minutes of walking 3 times per week for 16 weeks may not be enough to maintain or improve cardiorespiratory capacity. Moreover, it would be interesting to add conversation during walking to support better adherence but also a lower significant decline in cardiorespiratory capacity. It is important to note that the intensity could be considered low in this study because participants maintained a conversation while walking.[15] Finally, one study observed that linking aerobic physical activity with pleasure and choice promotes the integration of exercise as a lifestyle habit among LTC residents.[48]

Based on the literature, it is recommended that aerobic physical activity be performed at a moderate intensity in LTC. It has been shown that this intensity is beneficial and safe for the frail LTC population.[49] To manage intensity, 2 methods can be used: the perceived exertion scale or the breath scale. First, the perceived exertion scale (such as the Borg scale) is recognized to be a good tool to guide physical activity intensity in older adults.[49,50] This method is based on a self-reported scale of perceived exertion that ranges from 0 (no exertion) to 10 (maximum exertion), and is considered simple to implement.[51] A scale between 5 and 6 of 10 corresponds to moderate intensity, which is the recommended intensity to maintain or improve the physical function of the residents (Table 5).[49] Second, the breath scale is considered an easy-to-implement method to assess physical activity intensity. Briefly, maintaining a conversation while practicing physical activity is considered a clinical sign of low intensity. The intensity is rated as moderate if the person has some difficulty speaking but is still able to communicate. However, the intensity is considered high if the person cannot speak or maintain a conversation.[52,53] This method could be useful for residents with communication difficulties or major cognitive impairments. Finally, it is important to use other vital function monitoring tools to qualify and quantify intensity in older adults with medical complexity to ensure safety.[49] The maximum heart rate (HRmax) measurement is reliable and widely used to estimate exercise intensity in older adults with or without cognitive impairment. Indeed, an intensity with an HRmax between 64% and 76% is considered moderate.[52] In addition, it has been shown that intensity with an HRmax inferior to 60% is not sufficient to improve cardiorespiratory health in older adults.[54] In addition to heart rate monitoring, the HRmax can be estimated through a simple validated equation for older adults: $208 - (0.7 \times \text{age})$.[55] However, the HRmax may not be appropriate to quantify intensity in people taking certain medications (eg, hypertensive drugs). In this case, a talk test can be used.[53]

Resistance Training

Resistance training includes strength exercises performed using dumbbells, rubber bands, weight machines, or body weight (Table 2). Unfortunately, few studies have evaluated the effectiveness of

Table 2
Characteristics of Physical Activity Studies in LTC Facilities: Resistance

Author	Country	Participant (Number; Years; % Female)	Type of Intervention	Duration of Intervention	Evaluation	Outcomes	Results
Benavent-Caballer et al. 2014[26]	Spain	N = 89 G1: n = 22; 85.5 ± 4.7 y 68% female G2: n = 22; 82.9 ± 4.3 y 64% female G3: n = 22; 83.6 ± 3.6 y 64% female G4: n = 23; 83.6 ± 5.6 y 65% female	G1: voluntary contraction (knee extension with weight on the ankle) G2: contraction with electrical stimulation G3: contraction with electrical stimulation superimposed on voluntary contractions G4: control	30–35 min, 3x/wk for 16 wk	Baseline/16 wk	6-min walk, TUG, ultrasound (CSA), ADL (Barthel), handgrip, balance (Berg)	- TUG: Improvement only for G3 (+2.65 s; $P =$ .026). - ADL and femoral CSA: Significant improvements for G1, G2, and G3, but not for G4 ($P <$ .05). - Significant group*time interaction effect for TUG ($P =$ .02), CSA ($P =$ .001), and ADL ($P =$ .05).
Chiu et al. 2018[27]	Taiwan	N = 70 G1: n = 36; 79.6 ± 7.4 y 61% female G2: n = 34; 80.1 ± 8.3 y 38% female	G1: resistance with ankle and wrist weights G2: control	60 min, 2x/wk for 12 wk	Baseline/12 wk	Handgrip strength and pinching force	- Handgrip strength: Improvement for G1 (+3 kg; $P =$ .001) and decrease for G2 (−4.1 kg; $P =$ .038) + difference between groups ($P <$ .05). - Pinching force: Decrease for G2 only ($P =$ .006) + difference between groups (G1: +0.12 kg vs G2: −1.34 kg; $P =$ .014).
Buckinx et al. 2014[52]	Belgium	N = 35 G1: n = 18; 82.2 ± 9.0 y 65% female G2: n = 17; 84.2 ± 6.8 y 87% female	G1: movements on body vibration apparatus, "vibrotherapy" G2: control	3x/wk for 6 months	Baseline/6 and 12 mo	Balance and gait (Tinetti), TUG, quantitative analysis of walking, falls	- Step length measured during double tasks: Significant difference between groups (G1: −0.04 m vs G2: −0.12 m; $P <$ .01).
Alvarez-Barbosa et al. 2014[51]	Spain	N = 29 G1: n = 14; 84.0 ± 3.0 y 80% female G2: n = 15; 86.0 ± 7.5 y 86% female	G1: movements on body vibration apparatus "vibrotherapy" G2: control	3x/wk for 8 wk	Baseline/8 wk	TUG, STS 30 s, ADL (Barthel), quality of life (EuroQOL)	- TUG: Improvement for G1 only (−1.3 s; $P <$ .05) + difference between groups (G1: −1.3 s vs G2: +1.45 s; $P <$ .001). - STS 30 s: Improvement for G1 only (+4 rep; $P <$ .05) + difference between groups (G1: +4 rep vs G2: +0rep; $P <$ .001). - ADL: Difference between groups (G1: +5 pts vs G2: +0 pt; $P =$ .003). - EuroQOL mobility: Difference between groups (G1 −36.4% vs G2 +27.3%; $P <$ .001). - EuroQOL utility: Improvement for G1 only (+0.01 pt; $P <$ .05) + difference between groups (G1: +0.01 pt vs G2: +0 pt; $P <$ .001). - EuroQOL visual analogue scale: Improvement for G1 only (+10 pts; $P <$ .05) + difference between groups (G1: +10 pts vs G2: 0 pt; $P =$ .014).
Lam et al. 2017[49]	China	N = 73 G1: n = 25; 84 ± 6.7 y 52% female G2: n = 24; 82.4 ± 7.6 y 58% female G3: n = 24; 80.3 ± 7.3 y 54% female	G1: exercises (strength, balance, mobility) combined with whole-body vibration G2: exercises G3: control	60 min, 3x/wk for 8 wk	Baseline/8 wk	TUG, balance (Berg), balance confidence (scale), functional lower limb muscle strength (STS 5x), endurance (6-min walk test)	- Lower limb strength: Group*time interaction effect (G2: −6.8 vs G3: +1.6; $P =$ .048). - Balance confidence: Difference between groups (G1: +9.2 pts vs G2: +2.3 pts; $P =$ .033).

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Table 2 (*continued*)

Author	Country	Participant (Number; Years; % Female)	Type of Intervention	Duration of Intervention	Evaluation	Outcomes	Results
Gusi et al. 2012[50]	Spain	N = 40 G1: n = 20; 70 ± 8 y 75% female G2: n = 20; 76 ± 8 y 70% female	G1: balance work on Biodex G2: control	15 min, 2x/wk for 12 wk	Baseline/12 wk	Falls, fear of falling, isometric knee extension and flexion force, dynamic balance	- Dynamic balance: Significant difference between groups with an improvement for G1 (−2.1° (95% CI 1.3−3.0); $P < .001$). - Fear of falling: Significant difference between groups with an improvement for G1 (−8pts (95% CI 4 to 12); $P = .001$). - Isometric knee flexors: Significant difference between groups with an improvement for G1 (+7 Nm (95% CI 3−11); $P < .05$). - Isometric knee extensors: Significant difference between groups (+7 Nm (95% CI 1−13); $P < .05$).

CSA, cross-sectional area; G1, group 1; G2, group 2; G3, group 3; STS, Sit-To-Stand.
Searches for these studies were limited to the 2000s and were conducted in the PUBMED, CINAHL, and Embase databases. This is not a systematic review or meta-analysis.

resistance training in older adults living in LTC.[18,19] One of these studies showed that resistance training significantly improved grip strength and pinch strength but not body fat or muscle mass in sarcopenic-obese residents, compared with the control group.[19] Another study conducted a 16-week resistance training intervention and observed an improvement in gait parameters and ADLs.[18] In addition, a 12-week lower limb resistance training based on routine care reported improvements in quadriceps muscle strength, functional capacity, and physical activity energy expenditure in pre-frail and frail individuals.[56] In addition, 2 meta-analyses have been carried out in populations similar to LTC residents and showed an improvement in muscle strength and whole muscle mass in old and very old (>80 years) individuals[57] and benefits in terms of gait speed and muscle strength in sarcopenic older adults.[58] Thus, based on the literature, implementing the same resistance training protocol in older adults living in LTC could be safe and induce health benefits. It is important to note that the intensity of resistance training is not yet clearly established. Indeed, some studies suggest that resistance training at higher intensities (8 repetitions at 80% 1 repetition maximum) is safe[59] and produces greater improvements than moderate and low intensity.[60,61] In addition, performing high-intensity exercise in a geriatric rehabilitation or nursing home (5 times/week; 8 repetitions max) improved gait speed (4 m: +0.13 m/s).[62] Finally, a recent systematic review in older adults (79 trials; >60 years) showed that it is important to personalize resistance training because improvements in physical and functional abilities will differ depending on the intensity.[63]

In conclusion, the minimum practice is low-intensity training, but high-intensity training is best for individuals with no medical contraindications. Thus, the key to success is to personalize resistance training, which is feasible and safe in LTC and can lead to health improvements in residents without the obligation of using weight machines. Resistance can be provided through bodyweight training or by substituting weights with everyday objects, such as water bottles or towels.

Body and Mind Physical Activity and Functional Exercise

Body and mind physical activity consists of agility/flexibility training such as yoga or tai-chi (Table 3). A body and mind physical activity involves a multitude of movements performed slowly and precisely, while focusing on posture, balance, and joint range of motion.[64,65] This type of physical activity is a very interesting option for LTC residents to help maintain their autonomy through the improvement of the performance of ADLs. In addition, body and mind physical activity may also reduce the fear of falling and the risk of falls,[66] and can be performed using a chair, which is ideal for persons who use wheelchairs or have severe physical limitations. Participants in a 26-week tai-chi training showed improvements in self-esteem[25] compared with the control group, and pre-frail individuals in a 20-week tai-chi training improved their mobility.[28] Participants completing a 24-week yoga training also showed improvements in sleep quality, and a decrease in depression, sleep disorders, and daytime dysfunction.[24] Moreover, a systematic review concluded that long-term balance exercises prevent falls in LTC residents.[66] Finally, physical activity interventions that include music and stretching, flexibility, or range-of-motion exercises were found to improve balance, life satisfaction, and cognitive functioning.[27]

Functional exercises consist of similar movements to those performed during ADLs (Table 3). These exercises are simple: they do not require special equipment and can be performed standing or sitting. However, it was not possible to establish specific recommendations, as the published studies included 4 to 7 sessions/week and did not include the same exercises. Among these, one study

Table 3
Characteristics of Physical Activity Studies in LTC Facilities: Body and Mind and Functional Exercises

Author	Country	Participant (Number; Years; % Female)	Type of Intervention	Duration of Intervention	Evaluation	Outcomes	Results
Body and mind							
Chen et al. 2010[41]	Taiwan	N = 55 (75.4 ± 6.7 y; 53% female) G1: n = 31 G2: n = 21	G1: yoga G2: control	70 min, 3x/wk for 24 wk	Baseline/3 and 6 mo	Depression, sleep quality, compliance	- Depression: Improvement for G1 only (−3.1 pts; $P = .004$) + difference between groups after 6 mo ($P = .002$). - Sleep quality: Improvement for G1 (−1.5 pts; $P = .032$) and decrease for G2 (+2.3 pts; $P = .005$) + difference between groups after 6 mo ($P = .001$). - Compliance: 80%.
Lee et al. 2010[39]	China	N = 139 G1: n = 66; 83.4 ± 7.2 y 70% female G2: n = 73; 82.0 ± 6.9 y 66% female	G1: Tai-chi G2: control	2x/wk for 26 wk	Baseline/13 and 26 wk	Satisfaction of life, quality of life (SF12), Self-esteem, compliance	- Significant group*time interaction effect for physical self-esteem ($P = .02$) and for metal self-esteem ($P = .025$). - Compliance: 85.5%.
Wołoszyn et al. 2021[53]	Poland	N = 165 (74.35 ± 7.33 y) G1: n = 55; 54% female G2: n = 55; 65% female G3: n = 55; 58% female	G1: basic exercises G2: physical exercises with elements of dance movement therapy G3: control	30 min, 2x/wk for 12 wk	Baseline/12 and 24 wk	Handgrip strength, box and block test, arm curl test, balance (Berg), chair sit-and-reach, peak expiratory flow, ADL (Barthel and Katz), range of motion of the shoulder	- All parameters: Greater improvement for G2 compared with G1 at 12 and 24 wk ($P < .001$). - All parameters (except shoulder extension and Katz ADL): G1 and G2 improved significantly more at both times (12 and 24 wk) than G3 ($P < .001$).
Hagen et al. 2003[42]	United Kingdom	N = 60 (78.3 y; 70% female) G1: n = 20 G2: n = 20 G3: n = 20	G1: exercises to music (emphasis on stretching, flexibility and of light aerobics) G2: manual (sewing), social (bingo), and daily life (cooking) activities with social interactions G3: control	10 to 60 min, 3x/wk for 10 wk	Baseline/10 and 20 wk	Cognitive functioning (CAS), functional assessment (BRS), satisfaction of life (LSI), balance	- Cognitive function: Group*time interaction effect ($F(2, 144) = 19.16$, $P < .001$). - Physical function Group*time interaction effect ($F(4,114) = 18.27$, $P < .001$). - Balance: Group*time interaction effect ($P < .013$). - Life satisfaction: Group*time interaction effect ($P < .001$).
Faber et al. 2006[40]	Netherlan-ds	N = 232 G1: n = 66; 85.4 ± 5.9 y 80% female G2: n = 80; 84.4 ± 6.4 y 76% female G3: n = 92; 84.9 ± 5.9 y 80% female	G1: balance, mobility, transfer G2: tai-chi G3: control	90 min, 1 to 2x/wk for 20 wk	Baseline/20 wk	MMSE, quality of life (SF36), frailty, PA level, falls, mobility (POMA), physical performance scale (PPS), ADL, compliance	- Mobility: Significant difference between groups (G1 (+1.9 pts) vs G3 (+0.5 pt; $P < .05$); G2 (+2 pts) vs G3 (+0.5 pts; $P < .01$)). - Physical performance: Significant difference between groups only for pre-frail individuals (G1 + G2 vs G3) difference +0.7 (0.3 to 1.2); $P < .01$). - Compliance: 88% for G1 and 84% for G2.
Functional exercises							
Kerse et al. 2008[47]	New Zealand	N = 639 (n.a% female) G1: n = 310; 84.4 ± 7.2 y G2: n = 329; 84.1 ± 7.2 y	G1: ADLs (get up from a chair, walk, transfer) with fixation of objectives G2: control	Every day for 12 mo	Baseline/6 and 12 months	Falls and fear of falling, quality of life (EuroQol), TUG, balance, depression, self-reported function	All parameters: No difference between the groups ($P > .05$).
Roach et al. 2011[44]	USA	N = 82 (88.23 ± 6.13 y; n.a% female) G1: n = 28 G2: n = 29 G3: n = 25	G1: functional exercises (walk, sit-to-stand, staircase, transfer lying-down) G2: walk G3: control (conversation)	15 to 30 min 5x/wk for 16 wk	Baseline/16 wk	Transfer 6 min of walk	- Transfers: Group*time interaction effect ($P = .04$). More specifically, only G1 improved (+6%), whereas G2 (−5.7%) and G3 (−2.7%) decreased.

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Table 3 (*continued*)

Author	Country	Participant (Number; Years; % Female)	Type of Intervention	Duration of Intervention	Evaluation	Outcomes	Results
Schnelle et al. 2002[45]	USA	N = 190 G1: n = 94; 87 ± 8 y; 81% female G2: n = 96; 88 ± 7 y; 86% female	G1: walk, sit-to-stand, lifting of arms G2: control	4x/d, 5x/wk for 32 wk	Baseline/8 and 32 wk	30-s STS, incontinence, arm strength (curl and raise), walk or wheelchair distance, level of standing assistance	- 30 s STS: Improvement for G1 only (+1.4 rep; $P < .05$) + group*time interaction effect ($P < .01$). - Walk/wheelchair: Decrease for G2 only (−26 m; $P < .01$) + group*time interaction effect ($P < .05$). - Incontinence: Improvement for G1 only (−14%; $P < .01$) + group*time interaction effect ($P < .01$). - Arm curl strength: Improvement for G1 only (+4.5 pound; $P < .01$) + group*time interaction effect ($P < .01$). - Arm raise strength: Improvement for G1 only (+4 pound; $P < .01$) + group*time interaction effect ($P < .01$).
Simmons et al. 2002[46]	USA	N = 51 G1: n = 27; 89.9 ± 6.3 y; 93% female G2: n = 24; 90.3 ± 7.5 y; 92% female	G1: walk, sit-to-stand, lifting of arms G2: control	4x/d, 5x/wk for 32 wk	Baseline/8 and 32 wk	Pain, 30-s STS, walk or wheelchair distance	- 30 s STS: Improvement for G1 (+0.8 rep; $P < .05$) and decrease for G2 (−0.9 rep; $P < .05$) + group*time interaction effect ($P < .01$). - Walk/wheelchair: Decrease for G2 only (−47 m; $P < .01$) + group*time interaction effect ($P < .05$).
Slaughter et al. 2015[43]	Canada	N = 111 (6.1 ± 7.1 y; 73% female) G1: n = 56 G2: n = 55	G1: sit-to-stand exercise integrated into daily routine G2: control	4x/d for 6 mo	Baseline/3 and 6 mo	30-s STS, 1 rep STS, quality of life, functional independence measure (scale)	- Functional independence: Decrease for both groups G1 (−3.6 pts; $P < .001$) < G2 (−8.9 pts; $P < .001$) + group*time interaction effect ($P < .01$). - Quality of life: Improvement for G1 only (+3.0 pts) and decrease for G2 (−2.4 pts; $P = .02$). - 1 rep STS: Group*time interaction effect ($P < .01$).
Frändin et al. 2016[48]	Sweden Norway Denmark	N = 241 G1: n = 129; 85 ± 7.93 y 70.5% female G2: n = 112; 84.5 ± 7.3 y 79% female	G1: walk, sit-to-stand, balance, strength (individualized exercises) G2: control	Daily for 3 mo	Baseline/3 mo	Balance (Berg), PA level, transfer, 10 m of walk, sit-to-stand 5 reps	All parameters: No difference within or between groups ($P > .05$).

CAS, cognitive assessment system; CSA, cross-sectional area; G1, group 1; G2, group 2; G3, group 3; LSI, life satisfaction index; PoMA, Performance-Oriented Mobility Assessment; STS, Sit-To-Stand.
Searches for these studies were limited to the 2000s and were conducted in the PUBMED, CINAHL, and Embase databases. This is not a systematic review or meta-analysis.

Table 4
Characteristics of Physical Activity Studies in LTC Facilities: Combined

Author	Country	Participant (Number; Years; % Female)	Type of Intervention	Duration of Intervention	Evaluation	Outcomes	Results
Arrieta et al. 2018[35]	Spain	N = 112 G1: n = 57; 85.1 ± 7.6 y 74% female G2: n = 55; 84.7 ± 6.1 y 67% female	G1: strength (40%–60% 1 RM), balance, stretching, walk G2: control	45 min (supervised). 2x/wk + 15 min of walk/d for 3 mo	Baseline/3 mo	30 s STS, arm curl, SPPB, normal and rapid 4-m walking speed, prehension force, balance (Berg), 8 feet up and go, level of AP (actigraph), compliance	- 30 s STS: Decrease for G2 only (−1.5 rep; $P < .01$) + group*time interaction effect ($P < .001$). - Arm curl: Decrease for G2 only (−1.7 rep; $P < .01$) + group*-time interaction effect ($P = .003$). - SPPB score: Improvement for G1 (+1.2 pts; $P < .001$) and decrease for G2 (−0.8 pt; $P < .01$) + group*time interaction effect ($P < .001$). - Normal gait speed: Improvement for G1 (+0.09 m/s; $P < .01$) and decrease for G2 (−0.05 m/s; $P < .05$) + group*time interaction effect ($P = .001$). - Balance: Improvement for G1 (+2 pts; $P < .05$) and decrease for G2 (−3.7 pts; $P < .01$) + group*time interaction effect ($P < .001$). - 8 feet up and go: Decrease for G2 only (−0.05 m/s; $P < .001$) + group*time interaction effect ($P = .025$). - Steps/d and light PA time: both improved for G1 (+141 step/d; +5.2 min/d), whereas both decreased for G2 (−148 step/d; −6 min/d). - Compliance: 90.6%.
Pereira et al. 2017[36]	Portugal	N = 34 (82.4 ± 6.3 y) G1: n = 17; 88% female G2: n = 17; 82% female	G1: balance, coordination, flexibility, agility + memory stimulation exercises G2: control	70 min 2x/wk for 10 wk	Baseline/10 wk	Endurance (6-min walk), lower limb strength (30-s STS), agility (8-foot up and go), mobility, gait, balance	- Balance: Improvement for G1 only (+3.1 pts; $P < .05$) + difference between groups ($P < .05$). - Mobility: Improvement for G1 only (+4.8 pts; $P < .05$) + difference between groups ($P < .05$). - Lower limb strength: Improvement for G1 only (+3.8 rep; $P < .05$) + difference between groups ($P < .05$). - Gait: Improvement for G1 only (+1.7 pts; $P < .05$) + difference between groups ($P < .05$). - Aerobic endurance: Significant difference between groups (G1: +21.9 m vs G2: −4.4 m; $P < .05$).
Cichocki et al. 2015[37]	Austria	N = 222 G1: n = 104; 83.9 ± 6.5 y 88% female G2: n = 118; 85.3 ± 5.1 y 86% female	G1: balance, coordination, strength, postural exercises G2: control	60 min, 1x/wk for 20 wk	Baseline/20 wk	Quality of life (EQ5D), MMSE, compliance, pain, TUG	- Quality of life: Difference between groups (G1: +5.6 pts vs G2: −1.8 pts; $P = .001$). - Compliance: 58.5%.
Hewitt et al. 2018[38]	Australia	N = 221 G1: n = 113; 86 y; 63% female G2: n = 108; 86 y; 68% female	G1: strength + balance G2: control	30–60 min 2x/wk for 25 wk	Baseline/6 and 12 mo	SPPB, quality of life (SF36), fear of falling, area of mobility (LSA), rate falls	- SPPB score: Difference between groups (G1: +0.70 pts vs G2: −0.17; $P = .019$). - Falls rate: Reduction by 55% for G1.

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Table 4 (*continued*)

Author	Country	Participant (Number; Years; % Female)	Type of Intervention	Duration of Intervention	Evaluation	Outcomes	Results
Taguchi et al. 2010[39]	Japan	N = 66 G1: n = 31; 85 y; 81% female G2: n = 34; 84 y; 82% female	G1: exercises of flexibility, strength, balance and endurance G2: control	1x/wk for 12 mo	Baseline/12 mo	Lower limb strength, Handgrip strength, 6-min walk test, ADL, MMSE, depression, fear of falling, PA level (accelerometer), flexibility (sit and reach test)	- Lower limb strength: Improvement for G1 only (+5 kg; $P <$ .01) + difference between groups (G1: + 5 kg vs G2: −1.2 kg; $P =$ .004). - Flexibility: Improvement for G1 only (+8.5 cm; $P <$ .01) + difference between groups (G1: +8.5 cm vs G2: +0 cm; $P <$ .001). - Handgrip strength: Decrease for G2 only (−2.6 kg; $P <$ .01) + difference between groups (G1: −0.2 kg vs G2: −2.6 kg; $P <$ .001). - 6-min walk: Decrease for G2 only (−37 m; $P =$ .05) + difference between groups (G1: +18 m vs G2: −37 m; $P =$ .02). - Walking speed: Decrease for G2 only (−0.09 m/s; $P <$ .05) + difference between groups (G1: +0.15 m/s vs G2: −0.09 m/s; $P <$ .005). - Stride length: Decrease for G2 only (−0.03 m; $P <$ .01) + difference between groups (G1: +0.06 m vs G2: −0.03 m; $P =$ .002).
Gronstedt et al. 2013[40]	Sweden	N = 266 G1: n = 170; 85 ± 7.7 y 71% female G2: n = 152; 84.9 ± 7.6 y 76% female	G1: walk, balance, transfer, strength, endurance, AVQ + interest-based activities (art, music, gardening cooking) G2: control	Daily for 3 mo	Baseline/3 mo	ADL, PA level, 10-m walk/ wheelchair, Handgrip strength, rate of falls, transfers, balance (Berg), 5 rep STS	- Normal speed: Improvement for G1 only (+0.36 m/s; $P =$ .038). - Fast speed: Improvement for G1 only (+0.032 m/s; $P =$ .003). - 5-rep STS: Improvement for G1 only (−5.16 s; $P =$ .019). - ADL: Decrease for G2 only (−2.02 pts; $P =$ .012). - Balance: Decrease for G2 only (−2.37 pts; $P =$ .004) + difference between groups (G1: +0.6 pt vs G2: −2.37pts; $P <$ .05). - Transfers: Decrease for G2 only (−1.73 pts; $P =$ .024) + difference between groups (G1: +0.37 pt vs G2: −1.73 pts; $P <$ .05). - PA level: Difference between groups ($P <$ .05).
Rezola-Pardo et al. 2020[41]	Spain	N = 81 G1: n = 41; 84.7 ± 66.5 y 63% female G2: n = 40; 83.8 ± 6.3 y 68% female	G1: walk, strength, balance G2: walk	60 min 2x/wk for 12 wk	Baseline/12 wk	Physical performance (SPPB and Senior fitness test), balance (Berg), gait speed (4-m walk), TUG, PA level (actigraph), MoCA, anxiety, depression, loneliness, quality of life	- SPPB score: Improvement for G1 only (+22.1%; $P <$ .001) + group*time interaction effect ($P <$ .01). - 30 s STS: Improvement for G1 only (+33.3%; $P <$ .001) + group*time interaction effect ($P <$ .01). - 6-min walk test: Improvement for G1 only (+6.8%; $P <$ .05) + group*time interaction effect ($P <$ .05). - Arm curl: Improvement for G1 only (+34.5%; $P <$ .001) + group*time interaction effect ($P <$ .05). - Balance: Improvement for G1 only (+4.6%; $P <$ .001) + group*time interaction effect ($P <$ .01). - TUG: Improvement for G1 only (+10.8%; $P <$ .05). - Gait speed: Improvement for G1 only (+17.4%; $P <$ .01). - Anxiety: Improvement ($P <$ .05) for G1 (−51.5%) and G2 (−53.3%). - Quality of life: Improvement ($P <$ .05) for G1 (+6%) and G2 (+4.6%). - Depression: Improvement for G2 only (−49.4%; $P <$ .01).
Baum et al. 2003[42]	USA	N = 21 G1: n = 11; 88 y; 82% female G2: n = 10; 88 y. 67% female	G1: range-of-motion exercises and of seated strengthening G2: control	1 h, 3x/wk for 1 y	Baseline/3, 6, 9, 12 mo	TUG, balance (Berg), MMSE, physical performance tests	- TUG: Improvement for G1 (−18 s; effect size = 0.5). - Balance: Improvement for G1 (+4.8 pts; effect size = 0.32). - MMSE score: Improvement for G1 (+3.1 pts; effect size = 0.54). - Physical performance: Improvement for G1 (+1.3 pts; effect size = 0.40).

Courel-Ibànez et al. 2021[43]	Spain	N = 22 (n.a% female) G1: n = 10; 84 ± 10.5 y G2: n = 12; 87.2 ± 7.6 y	G1: 24 wk of training (Vivifrail: strength, balance, flexibility, endurance) followed by 6 wk of de-training G2: 4 wk of training (Vivifrail) followed by 14 wk of de-training	5x/wk for 24 or 4 wk	Baseline/post-training, post de-training	Nutritional status (MNA), ADL (Barthel), IADL (Lawton), fear of falling (FES-I), MMSE, sarcopenia (SARC-F), functional performance (SPPB, TUG, Handgrip strength, 30sec STS, gait speed [6 m])	- Functional performance: delta change higher after 4-wk of training (short term) for both groups (effect size = 0.32 −1.44; *P* = .044) + additional improvement (10%–20%) for G1 (*P* = .036) after 24 wk of training. - Frailty status: reverse in 36% of participants. - De-training impact: loss of strength and functional abilities (10% to 25%) for both groups (effects size = 0.24–0.92; *P* = .039).
Stathi et al. 2007[44]	UK	G1: 14; 80 to 99 y; 85% female	G1: stretching, endurance, resistance, balance, tai-chi	60 min, 1x/wk for 6 mo	Baseline and 6 mo	Exercise experiences by interview	- Perceived quality of life: improved through better mobility + a decrease in fear of falling and higher feelings of achievement and success.
Mouton et al. 2017[45]	Belgium	N = 21 G1: n = 10; 82.5 y; 60% female G2: n = 11; 89.9 y; 72.7% female	G1: exercises via a giant board game (strength, flexibility, balance, endurance) G2: control	30 to 60 min, 2x/wk for 1 mo	Baseline/1 and 3 mo	Physical activity level (actigraph), MMSE, Quality of life (EuroQol 5D), SPPB, TUG, lower limb isometric muscle strength, balance (Tinetti), Relative autonomy index	- Number of steps (n/d): Improvement for G1 (+79.5; *P* = .04) and decrease for G2 (−855; *P* = .02) after 1 mo + improvement for G1 only (+754; 0.03) after 3 mo. - Energy expenditure: Improvement for G1 (+112 kcal/d; *P* = .01) and decrease for G2 (−88 kcal/d; *P* = .03) after 1 mo + improvement for G1 (+205 kcal/d; *P* = .02) and decrease for G2 (−212 kcal/d; *P* < .01) after 3 mo. - Quality of life: Improvement for G1 only (+0.1 pt; *P* = .04) after 3 mo. - Balance: Improvement for G1 only (+1.8 pts; *P* = .02) after 3 mo. - Ankle extensors strength: Improvement for G1 only after 1 mo (+26 N; *P* = .04) and after 3 mo (+45 N; *P* = .02). - Ankle flexors strength: Improvement for G1 (+31 N; *P* = .03) and G2 (+12e; *P* = .04) after 1 mo + improvement for G1 (+23N; *P* = .03) but decline for G2 (−13 N; *P* < .01) after 3 mo. - Hip flexors strength: Improvement for G2 only (+17 N; *P* < .01) after 1 mo. - Relative autonomy index: Decrease for G2 only (−13 pts; *P* = .02) after 3 mo.

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Table 4 (*continued*)

Author	Country	Participant (Number; Years; % Female)	Type of Intervention	Duration of Intervention	Evaluation	Outcomes	Results
Buckinx et al. 2020[46]	Belgium	N = 21 G1: n = 11; 70 y; 36% female G2: n = 10; 84.5 y; 60% female	G1: exercises via a giant board game (strength, flexibility, balance, endurance) G2: control	30 min, 2x/wk for 1 mo	Baseline/1 mo	Risk of falls (Tinetti), TUG, SPPB, Handgrip strength, walking speed, lower limb muscle strength, quality of life (EQ5D), motivation	- Fall risk: Improvement for G1 only (+0.73 pt; $P = .04$) + difference between groups (G1: (+0.73 pt vs G2: −0.7 pt; $P < .0001$). - SPPB: Improvement for G1 only (+2.55 pts; $P < .0001$) + difference between groups (G1: +2.55 pts vs G2: +0 pt; $P < .0001$). - Iso knee extensor strength: Improvement for G1 (+27 N; $P = .03$) and decrease for G2 (−25 N; $P = .01$) + difference between groups ($P = .04$). - Iso knee flexors strength: Improvement for G1 only (+26 N; $P = .004$) + difference between groups (G1: +26 N vs G2: −6 N; $P = .02$). - Iso hip abductors strength: Improvement for G1 (+50 N; $P = .01$) + difference between groups (G1: +50 N vs G2: −15 N; $P = .002$). - Iso hip extensors strength: Improvement for G1 only (+32 N; $P = .04$) + difference between groups (G1: +32 N vs G2: −1.96 N; $P = .01$). - Iso ankle extensors strength: Improvement for G1 only (+155 N; $P = .01$) + difference between groups (G1: +155 N vs G2: −19.32 N; $P = .004$). - Quality of life (mobility, self-care, usual activity): difference between groups ($P < .0001$). - Intrinsic motivation: Improvement for G1 only (+2.37 pts; 0.04) + difference between groups (G1: +2.37 pts vs G2: +1.2pts; $P = .02$). - Walking speed: Improvement for G2 only (+0.08 m/s; 0.04). - TUG: Difference between groups (G1: −1.67 m/s vs G2: −1 m/s; $P = .02$).

Magistro et al. 2021[47]	Italy	N = 111 G1: n = 69; 82.7 ± 8.5 y 87% female G2: n = 42; 81.7 ± 10.5 y 88% female	G1a: group PA classes (strength, walk, balance) + individual session (strength maintenance and articular mobility) + educational and recreational activity without dementia G1b: group PA classes (strength, walk, balance) + individual session (strength maintenance and articular mobility) + educational and recreational activity with dementia G2: control	5x/wk for 1 y	Baseline/12 mo	Mobility, balance, gait and risk of falls evaluated by Tinetti, perception of effort (Borg), Handgrip strength, depression, ADL, strength of upper extremity, flexibility and mobility of shoulders	- Mobility: Group*time interaction effect (P = .001). More specifically, G1a (+13.0%) and G1b (+18.3%) improved whereas G2 (−14.8%) decreased. - Perception of effort: Group*time interaction effect (P = .001). More specifically, G1b (−8.27%) improved whereas G1a (+1.96%) and G2 (+35.7%) decreased. - Arm curl strength (right): Group*time interaction effect (P = .001). More specifically, G1a (+31.1%) and G1b (+13.9%) improved whereas G2 (−22.0%) decreased. - Arm curl strength (left): Group*time interaction effect (P = .001). More specifically, G1a (+35.3%) and G1b (+35.4%) improved, whereas G2 (−20.2%) decreased. - Shoulder flexibility (right): Group*time interaction effect (P = .013). More specifically, G1a (−38.3%) and G1b (−7.47%) improved whereas G2 (+14.0%) decreased. - Shoulder flexibility (left): Group*time interaction effect (P = .011). More specifically, G1a (−10.4%) and G1b (−4.0%) improved, whereas G2 (+29.1%) decreased. - ADL: Group*time interaction effect (P = .001). More specifically, G1a (−5.36%) and G1b (−7.58%) improved, whereas and G2 (+50.6%) decreased. - Depression: Group*time interaction effect (P = .001). More specifically, G1a (−8.63%) and G1b (−6.96%) improved, whereas G2 (+17.9%) decreased.

ADL, activity daily living; CSA, cross-sectional area; EQ5D, EuroQoL-5D; FES-I, Falls Efficacy Scale International; G1, group 1; G2, group 2; G3, group 3; LSA, Life-Space Assessment; MNA, Mini Nutritional Assessment; MoCA, Montreal Cognitive Assessment; PA, physical activity; RM, repetition maximum; SARC-F, Strength, Assistance with walking, Rising from a chair, Climbing stairs, and Falling; STS, Sit-To-Stand; SPPB, Short Physical Performance Battery (range score 0 to 12).

Searches for these studies were limited to the 2000s and were conducted in the PUBMED, CINAHL, and Embase databases. This is not a systematic review or meta-analysis.

Table 5
Exertion Intensity With Modified Borg Scale (0–10)

Rating	Perception of Exertion	Possible Related Activity
0	No exertion	*Lying rest* (ie, sleeping)
0.5	Extremely easy	*Sitting rest* (ie, watching TV)
1	Very easy	*Light activity* (ie, walking slowly, playing cards, etc) ➢ Very easy to speak, breathe, and maintain a conversation
2	Easy	*Light to moderate activity* (ie, gardening)
3	Moderate	➢ Easy to speak and breathe, but maintaining a conversation is challenging
4	Moderately difficult	*Moderate activity* (ie, biking, walking fast)
5	Difficult	➢ Some difficulties to talk but breathing becomes challenging
6	Very difficult	*Vigorous activity* (ie, running or mounted bike)
7		
8		➢ Can pronounce a sentence, but breathing becomes more arduous
9	Extremely difficult	*Very vigorous activity* (ie, climbing stairs quickly) ➢ Can pronounce a few words but it is also very hard to speak and breathe
10	Maximal exertion	*Maximum activity* (ie, doing consecutive sprints) ➢ Unable to talk or to pronounce a few words

Self-reported scale to guide physical activity intensity. Ranges from 0 (no exertion) to 10 (maximum exertion); 5–6/10 corresponds to moderate intensity (recommended in LTC setting).[49,51,52] The potential related activities should be considered as examples. Indeed, some people can consider an activity 2/10 whereas others can quote it 5/10 because the perception of exertion depends on fitness level.

integrated the sit-to-stand exercise into the participants' daily routine, with 4 sessions per week for 6 months. They observed an improvement in this task as well as on the quality of life in LTC residents with dementia.[33] Another study (exercises: walk, sit-to-stand, staircase, transfer lying-down) only showed an improvement in transfer compared with the control group.[30] The third study (exercises: walking, sit-to-stand, lifting of arms; 4 sessions/day, 5 times/week for 32 weeks)[31] reported improvements in the 30-second sit-to-stand test[31,32] and arm strength[31] compared with the control group. However, 2 other studies observed that implementing individualized daily functional exercises did not lead to health improvements.[29,34]

Other researchers have focused on *exercises using stimulation/vibration machines*. It has been reported that functional exercises combined with a vibration machine improved balance confidence compared with the functional exercise group.[22] Another balance study using a Biodex in addition to usual care showed an improvement in dynamic balance, fear of falling, and isometric strength.[23] Finally, a third study added vibration exercises to usual physiotherapy care and noted more improvement in functional capacities [Timed-Up & Go (TUG), 30-second sit-to-stand test]; ADLs, and quality of life compared with persons receiving only usual physiotherapy care.[21] However, another study using a physical activity program with vibration platform movements showed no improvement.[20] Overall, the value of this type of exercise modality is uncertain considering the cost, space required, and lack of improvement in participants (number of variables or delta change).

In conclusion, balance training has been shown to improve postural stability, balance confidence, and reduce fear of falling in older adults in LTC. Therefore, it is interesting and important to include body and mind exercises in a physical activity session. However, it is not necessary to dedicate a specific physical activity session to this type of exercise.[26,49] Interestingly, body and mind physical activity can be performed sitting, which allows the participation of LTC residents with reduced mobility.

Combined Physical Activity

Numerous studies performed in LTC recommend the implementation of a combined physical activity intervention (Table 4). A meta-analysis including 12 studies concluded that a combined physical activity program [type: resistance (strength) and body and mind (balance); frequency: 2-3 times/week; duration: 6+ months] could prevent falls in LTC residents with reduced mobility.[67] Moreover, a systematic review showed that practicing combined moderate-intensity physical activity is the best intervention to improve quality of life, autonomy, balance, and anxiety in frail older adults.[68] For example, performing only 1 session/week for 12 months improved lower limb strength but not upper limb strength,[39] and for 20 weeks, found that quality of life improved, but no impact was observed on cognitive function or functional health.[37] An third study showed that gardening once a week reduced the feeling of loneliness and improved enjoyment of life.[69] Therefore, based on these studies, 1 session/week can have measurable impact on some aspects of quality of life, such as better mobility, feelings of achievement, or a reduced fear of falling.[44]

However, performing 2 sessions/week for 3 months improved Short Physical Performance Battery (SPPB) scores, gait speed, and balance.[35,41] Performing during 1 month increased energy expenditure, SPPB scores, isokinetic knee extensor strength, and balance.[45,46] Furthermore, implementing 25 weeks of strength and balance training improved SPPB scores and decreased the rate of falls.[38] Finally, 2 physical activity sessions of combined exercises per week for 10 weeks plus cognitive training improved physical function and selective attention.[36]

Other studies implemented physical activity more than 3 times/week: One study observed improvements on TUG, Berg balance, and cognition tests after a 1-year intervention.[42] Another study reported improvements in functional performance and strength after a 4-week intervention.[43] Furthermore, the authors observed that adherence to a 24-week intervention produced an additional 10% to 20% improvement and reversed frailty in 36% of participants.[43] Those who did not pursue the physical activity intervention lost strength and functional abilities.[43] In another study, participants in a 1-year intervention showed a reduction in symptoms of depression and an improvement in balance, upper limb strength, and basic ADLs compared with the control group.[47] Finally, 12 weeks of daily supervised, individualized training improved balance, physical activity levels, and transfers in LTC residents compared with the control group.[40] However, it is important to mention that one of the main barriers to implementing a daily exercise intervention in LTC is a lack of support and staff.

It is recommended that each physical activity session include flexibility, balance, resistance, and endurance exercises and last between 35 and 45 minutes/session, 2 times/week.[49] In addition, it has been observed that group physical activity training incorporating music not only helps maintain motivation,[49] but also reduces depression and anxiety,[70] which often affects LTC residents.

General Recommendations

Small changes can be made to break sedentary cycles in lifestyle to significantly improve the physical and psychological state of LTC residents as well as their quality of life.[71] Therefore, it is beneficial to interrupt sedentary time with physical activities of various intensities and modalities.

Since the most recent LTC physical activity consensus, articles evaluating the effects of physical activity in LTC have been published. Thus, an update of the physical activity recommendations in LTC is

Table 6
Recommendation on Physical Activity and Reduction of Sedentary Time in LTC

Type of Recommendation	Recommended Time	Type of Exercise and Intensity Recommended	
		For People Without Mobility Disorders	For People With Mobility Disorders*
Physical activity frequency	2 sessions/wk 35−45 min/session	NA	NA
Exercise session:			
➢ Warm-up	4 min	Mobility exercises (wrists, shoulders, hips, knees, and ankles) followed by low-intensity walking	Seated mobility exercises followed by low-intensity wheelchair propulsion
➢ Balance/coordination	8 min	Standing balance (increasing difficulty), weight transfer work, changes of direction	Seated tai-chi
➢ Resistance	15 min	Sit-to-stand exercises (increasing difficulty), knee extensions and flexions with ankle weights, upper body and core exercises with resistance bands ∘ 1−2 sets — 8 to 10 exercises ∘ 13−15 repetitions max (50% of 1 RM) = low intensity ∘ 8 repetitions max (80% of 1 RM) = high intensity	Half sit-to-stand, seated muscular reinforcement (lower and upper body or core exercises with resistance bands)
➢ Endurance	15 min	5 walking sequences of 3 min[†] interposed with 2 balance and/or strength exercises	Chair dance or wheelchair propulsion
➢ Cool-down	3 min	Low-intensity walking and stretching *10 to 30 s/exercise; to be performed at maximum capacity without reaching pain*	Low-intensity wheelchair propulsion, seated stretching
Reduce sedentary time	3 periods/d 2−5 min/time	ie, during a TV commercial break (walking, dancing, or repeated sit-to-stand with chair) Each move counts, ie, walking to the dining room and not using wheelchair (when it is not needed)	Walking using wheelchair, seated dancing or repeated half sit-to-stand on wheelchair

NA, nonapplicable; RM, repetition maximal.
These recommendations are based on different studies.[24,52,62,63,72,75,76,94]
*These recommendations are not specific and exhaustive due to limited literature available on wheelchair physical activity (a new tool for both LTC populations is in progress [PUSH tools]).[31,79-81,89]
†Self-reported exertion perception scale (Borg): 5−6/10 (Table 2).

needed, which should focus on the personalization of physical activity programs based on needs, according to level of dependence (Table 6).

Finally, it is important to be able to evaluate the effectiveness of the implementation of a physical activity program. To do this, there are many tests specifically validated for LTC that assess the loss of autonomy and functional capacities.[72]

Safety Considerations

Adapted to the Level of Mobility

It has been shown that it is feasible and safe for LTC residents to perform physical activity,[73-75] even for persons with major neurocognitive disorders[76]; however, the level of disability, dependency, and health varies greatly among residents in LTC. The only recommendations published provide general information, such as keeping people as active as possible, taking into account their capacities and health status, but also adapting the program with the help of a physical activity professional.[49]

As mentioned in the recommendations, it is important to engage every individual regardless of their physical independence, as most LTC residents use wheelchairs or rolling bases.[77,78] First, it has been shown that frail older adults who participated in a 12-week (2 sessions/week) seated (wheelchair or chair seat) tai-chi intervention improved pain management and increased upper limb muscle strength compared with the control group.[79] Other studies implementing a 12-week chair dancing intervention (2 sessions/week) reported improvements in upper extremity strength, balance, ADLs, manual dexterity, flexibility and shoulder range of motion.[26] Moreover, it has been observed that a total of six 60-minute wheelchair exercise training sessions improved space mobility through push angle and decreased push frequency compared with the control group.[80] Overall, these studies confirm that physical activity interventions are feasible and safe and that even simple exercises can lead to health benefits in LTC residents using wheelchairs.[81]

Studies focusing on assisted muscle strengthening sessions (3 sessions/week for 1 year) observed an improvement in cognitive state as well as gait parameters and balance.[42] Finally, it was observed that more than half of terminally ill LTC residents were able to perform physical activity safely and benefited.[82] Few studies have integrated exercises in the sitting position; therefore, it is essential to develop recommendations and specific physical activity programs according to the level of autonomy (independent walking, wheelchair, bedridden) of all LTC residents.

Individualized Sessions

Any type of exercise must be adapted to the individual's capacities, which should not be over- or underestimated. One study reported that frail older adults with comorbidities expressed the desire for personalized sessions with individualized and adapted objectives, which would support their adherence.[83] Thus, it is important to consult an exercise physiologist/kinesiologist specialized in gerontology/adapted physical activity or a physical therapist to prescribe a specific, safe, but also beneficial program. New tools based on a decision tree generating an adapted physical activity program have been shown to be feasible in community-dwelling and hospitalized older adults, as well as persons admitted to the emergency department.[84-86] This specific tool limits ageism but also avoids over- or underestimation of physical capacities.

Facilitators and Barriers to Integrating Physical Activity in LTC

To effectively implement the physical activity interventions presented in this article, several barriers must be taken into consideration.[83,87-93] The barriers, expressed by residents and/or staff, are as follows: (1) *individual* (*intrapersonal*): fear of falling, lack of time, lack of self-determination, lack of interest, perception of their health condition (eg, pain, physical limitation, dizziness, balance disorders), sedentary life history, lack of awareness/knowledge of the benefits and risks of physical activity; (2) *environmental (external)*: lack of funds, lack of human resources, lack of space or equipment, lack of incentive/willingness from administrators to encourage participation in physical activity, ubiquitous routines with specific schedules, accessibility issues; (3) *interpersonal (relationships):* not having an exercise partner, lack of knowledge, preconceived ideas, and ageism (in particular from health professionals).

The following are facilitators[83,87-93]: (1) *individual* (*intrapersonal*): enjoyment of practicing physical activity, achieving objectives, feeling of self-efficacy, improved perception of health condition (eg, weight loss, pain reduction, maintaining autonomy); (2) *environmental* (*external*): access to an outdoor courtyard/garden to walk, access to benches to sit, free and dedicated space; (3) *interpersonal* (*relationships*): social support, encouragement provided by family, friends, or staff.

Therefore, based on barriers and facilitators from the literature, it would be important to teach the benefits of physical activity for health in this population as well as the care team responsible for their well-being. Before implementing a physical activity intervention, it is also important to consider their fears/worries/pain, and their individual preferences or desires. Educating the professional team could help to limit "ageism," which unfortunately affects 1 in 3 people, according to the latest World Health Organization (WHO) report.[91] In addition, gardening, walking, and crafts have been reported as activities of choice for LTC residents[48] and should be promoted in LTC facilities. These activities can also include pets/animals or the use of technology because it has been shown that they reduce feelings of loneliness, improve participation in activities, and increase physical activity time for institutionalized individuals.[17,49,71] Finally, it is essential to involve the care teams, as well as family and friends, in physical activity to establish and maintain good practice.

Conclusion/Implications for Practice and/or Research

The implementation of physical activity aiming to reduce sedentary behavior and physical inactivity in LTC is a key strategy to preserve the physical health and quality of life of residents. One of the WHO's priorities is preventing sedentary lifestyles and physical inactivity, which is the fourth leading cause of mortality. However, this approach is not sufficiently implemented.

Overall, it is recommended that LTC residents practice moderate-intensity multimodal/combined physical activity training aiming to improve muscle strength and cardiorespiratory endurance. To maintain/improve aerobic capacity, residents should walk continuously or use interval intensities. To build muscle strength, residents should perform resistance training with an emphasis on the lower limbs. In addition, it is important to add flexibility and balance exercises during each physical activity session (ie, during warm-up/cool-down). Furthermore, to be effective, the physical activity intervention must be reviewed according to the resident's abilities and preferences and include the health care team or caregivers. This awareness is critical for LTC residents to limit deconditioning, dependency, and, therefore, improve their quality of life. It is important to note that these recommendations target dependent people in LTC, as defined in the introduction, and not the small fraction visiting nursing homes for rehabilitation, which is common in some countries. These individuals have very different physical profiles, and other more adapted tools are more appropriate.[84,85,94]

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