



## Physical activity interventions to improve the quality of life of older adults living in residential care facilities: a systematic review

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### ABSTRACT

**Purpose:** Pursuing active aging and maintaining the quality of life (QoL) is essential, particularly in older people living in residential care facilities (RCFs). We evaluated physical activity (PA) as an intervention to improve the QoL in this population, trying to hypothesize future perspectives in this field.

**Methods:** A systematic search was performed on Pubmed. Only randomized control trials or quasi-experimental control group trials were considered.

**Results:** Results showed that a high-frequency PA can be effective in older people, allowing them to improve their functional mobility, autonomy, anxiety level, balance, and social interactions. Moreover, a moderate-intensity PA showed the most interesting results, improving all the QoL-related aspects considered.

**Conclusion:** Results highlight the beneficial effects of multidisciplinary intervention strategies in increasing QoL and QoL-related aspects of RCFs older residents, contemplating PA as the main instrument. However, structured PA is necessary to fully understand which protocol could be the most effective.

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### Introduction

The Quality of Life (QoL) is defined by the WHO as “an individual's perception of the position in life in the context of the culture and value systems in which individual lives and in relation to his goals, expectations, standards, and concerns”.<sup>1</sup> Consequently, it is a broad-ranging concept that could be affected by physical health, psychological state, personal beliefs, social relationships, and the relationship with the environment. Moreover, the QoL concept becomes more complex in older adults' context, and even more in the context of older people who live in residential care facilities (RCFs).

The entry into RCFs represents one of the most delicate events of older adults' life, influencing their psychological balance and representing a radical change in their daily routine. It could involve a great loss of autonomy and of the decision-making space of older people, which can trigger pejorative chain reactions, also due to the physiological losses caused by aging itself.<sup>2</sup> Therefore, several concepts must be considered to evaluate the QoL in this sub-population, and

different interventions can be performed to improve the QoL of people who enter RCFs.

Epidemiological data confirm the “population aging” concept, defined as the shifting in the distribution of a country's population towards older ages; by 2050, the World's population aged 60 years and older is expected to reach 2 billion, up from 900 million present in 2015. Moreover, the 125 million people aged 80 years or older present today, are going to increase up to almost 650 million in 2050.<sup>3</sup>

We must therefore consider that a longer life brings possible changes in personal capacities; however, the extent of these capacities depends on two interconnected fundamental factors: health and QoL. The key objective of health and QoL in active aging is to maintain autonomy and independence, promoting physical and mental health, social inclusion, in need-of-care people, too. The aim of caring for older people should be multidisciplinary care, considering the environment in which older people find themselves, allowing a healthy aging, a meaningful life in the period of older ages.<sup>4</sup>

Global aging led to a growing need for long-term care facilities; RCFs offer services to older people who need care that cannot be taken at home.<sup>5</sup> RCF is a generic term used to describe different forms of residential provision, in which assisted living and nursing homes are included. In assisted living, also called “low-level dependence homes”, people who need help with daily care are admitted, living in their rooms, and sharing common areas to perform social and recreational activities. Otherwise, nursing homes, also called “skilled nursing facilities”, provide a wide range of health and personal care

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services, which include nursing care, 24-hour supervision, help during meals, and assistance with everyday activities.<sup>5</sup>

Evaluating the QoL level of older people living in RCFs is essential, to understand how it is possible to improve it, training the caregivers to meet the residents' needs, and performing intervention programs. Several studies concerning the RCF residents' perceived QoL are available, most of which are based on standardized questionnaires to evaluate different items and health-related domains, as energy perceived, pain, social isolation, and physical mobility. Moreover, in almost all the studies other factors were evaluated, such as depression level, life satisfaction index, anxiety, fear of falling and cognitive impairment, to find possible QoL determinants in RCFs older adults. Among them, caregivers' attitude, independence, the "in-making person" feeling, and the number of hours spent with relatives were identified as fundamental determinants of RCFs older adults' QoL.<sup>6–10</sup> Moreover, the concept of individuality became prominent in different studies, recognized as the ability to remain independent, living in private spaces with personal possessions, building up a safe environment;<sup>7,11</sup> furthermore, the empowerment, as the level of autonomy and personal control in making choices, was found as positively correlated to the perceived QoL.<sup>8,9,12,13</sup> Conversely, determinants that negatively impact the QoL were identified, too. Feeling lonely, with consequent social isolation, high depression levels, mobility impairment, pain perception, fear of falling and anxiety were the most prominent ones in different studies.<sup>14–16</sup>

Overall, data highlighted the complexity and multidimensional features of the QoL issue. This implies the importance of not only enhancing the functional status of RCF older people but also of considering the concept of individuality, contemplating the relationship with the caregivers and family, thinking of older adults as "in-making" and empowered people as much as possible.

Concerning the beneficial effects of physical activity in older adults, the recommendations given by WHO postulated for adults aged 65 and above must be considered.<sup>17</sup> Particularly, it is essential to remember that in this group of people "physical activity" comprises leisure-time physical activities, too. Hence, it can be assumed that physical activity could give effects that will be more impactful than merely improving coordination or physical skills. Walking, cycling, dancing, gardening, swimming, playing, gaming, in the context of daily activities, are all activities included in the concept of physical activity for older adults. To improve physical skills, to reduce the risk of chronic diseases and to lower the probability of depression and cognitive decline, WHO recommended at least 150 min of moderate-intensity aerobic physical activity per week, or at least 75 min of vigorous-intensity aerobic physical activity per week, performing the exercise in bouts of at least 10 min. Moreover, in the case of elders with poor mobility, physical activities to enhance balance and to prevent falls are suggested, for 3 or more days per week.<sup>17</sup>

According to different guidelines published during the last decade, moderate intensity is generally defined as 3–6 metabolic equivalents (METs) and causes a noticeable increase in heart rate and breathing effort.<sup>18</sup> Activities of moderate intensity can include fast walking, dancing, gardening, and stair climbing. Otherwise, the activities classified as lower than 3 METs, are considered low-intensity ones. Walking slowly, making the bed, eating, preparing food, and washing dishes are examples of low-intensity physical activities.

Strong evidence demonstrated that the benefits of regular physical activity include, for active older adults: the reduced risk of developing noncommunicable diseases, such as major cardiovascular and metabolic diseases, the lowered risk of falls and cognitive impairments, and the reduced risk of osteoporosis and muscular weakness.<sup>19–22</sup> Furthermore, physical activity in older adults was shown to have a protective role in dementia and mental diseases, delaying the onset,<sup>23,24</sup> to maintain health and physical function, and to reduce falls.<sup>25–27</sup>

For these reasons, this review aimed to identify physical activity and multidimensional interventions tested in RCFs to improve different aspects of older adults' QoL. Particularly, the main goal of this article was to find out the effectiveness of the different interventions proposed, evaluating their effects on the QoL or QoL-related aspects of the participants. The understanding of the characteristics that must be considered in physical activity interventions planned for RCFs older adults - type of physical activity, intensity, and frequency - could help obtain standardized and tailored strategies in this field.

## Methods

The systematic narrative synthesis methodology was adopted, to find, summarize, explain, and interpret existing evidence.<sup>28</sup> This systematic review was performed following preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines.<sup>29</sup>

### Data source and search strategy

NCBI Pubmed was used to search relevant literature, on December 10<sup>th</sup>, 2020, using the following terms: (quality of life) AND (residential care facilities), (physical activity interventions) AND (aged residential care facility). For the second item searched, the filter "Clinical Study" was activated.

### Inclusion criteria

To our knowledge, no previous reviews were published about the classification of physical activity and multidimensional interventions to improve QoL in RCFs older people; therefore, no filters for publication dates were applied.

Articles were included if published in English and if they reported data about interventional approaches to improve older adults' QoL.

Moreover, studies were included if:

- participants were healthy subjects living in RCFs; assisted living and nursing homes were considered;
- participants aged 65 years or older, without diagnosed diseases specified in the exclusion criteria;
- participants were representative of both genders, to exclude bias due to the samples' different type;
- the group of the recruited older adults was composed of at least 20 participants;
- QoL or health-related aspects were assessed by validated questionnaires and/or tests;
- the intervention proposed lasted at least 4 weeks;
- the research design was a randomized control trial or a quasi-experimental control group trial.

### Exclusion criteria

Reviews and meta-analyses were excluded. Moreover, studies were excluded if participants were affected by mental illnesses, Alzheimer's disease, Parkinson's disease, dementia, or severe disabilities. Furthermore, studies were excluded if the QoL-related aspects were assessed by semi-structured interviews, and not by validated questionnaires.

The found references were examined for duplicates and screened by title and abstract; the full text for eligible studies was then sourced. The selection procedure is reported in Fig. 1.

**Data extraction** Two authors (G.Ba and M.D.S.) screened articles according to the eligibility criteria. They independently assessed the eligibility and performed the final article selection. From each study, the following variables were extracted: the name of the first author, the year of publication, the sample size, the country, the intervention

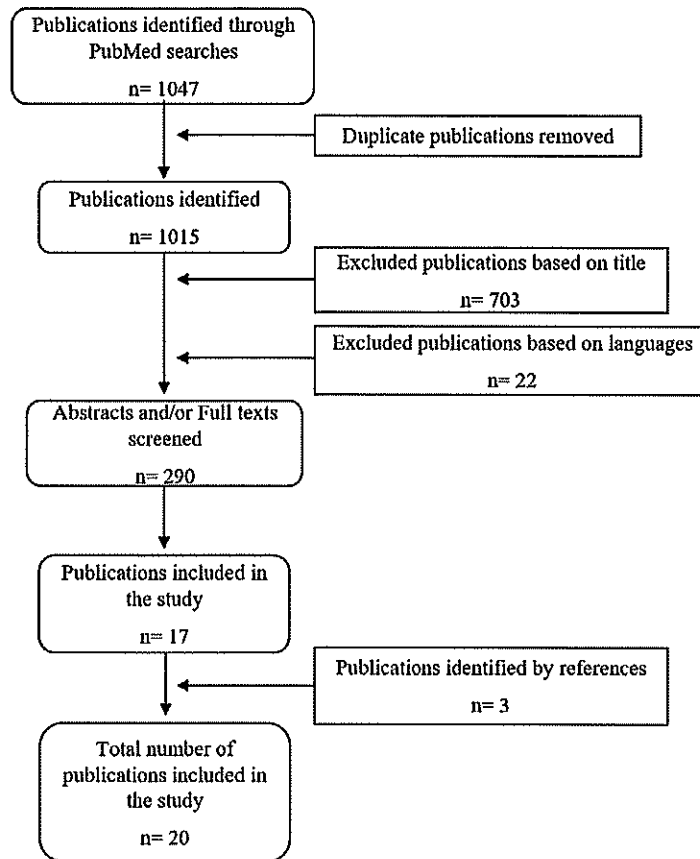


Fig. 1. Selection procedure to find eligible publications

strategy (duration, type, frequency, and intensity), the aim of the study, methods, and results.

**Methodological Quality Assessment** The methodological quality of the eligible trials was assessed by calculating the Jadad score.<sup>30</sup> A total score ranging from 0 to 5 was received by articles, based on methodological aspects: randomization, blinding, and description of withdrawals. Outcomes are described in Supplementary Table S1.

## Results

### Study selection and study characteristics

We found 1015 non-duplicated eligible citations; we excluded 725 articles by their title or language; after screening 290 citations by their abstract or full reading, we found 17 eligible articles and added 3 articles found by references screening. Twenty articles were included in the review (Fig. 1).

Four studies were performed in Spain, three in China, two in the United Kingdom, one in Australia, two in Taiwan, one in Italy, one in the USA, one in Austria, one in Belgium, one in Portugal, one in Japan, one in Turkey and one in New Zealand. The studies included 7 single-center studies and 13 multicenter studies. Eight studies were published in the last 5 years, 9 studies between 2010 and 2014, 3 studies before 2010.

### Data extraction and studies' quality assessment

RCF older adults' QoL and health status can be affected by a wide variety of factors. Therefore, we decided to focus on the QoL-related variables most reported in the literature: depression and anxiety, functional mobility and fitness status, body pain, fear of falling, and

life satisfaction. The quality of eligible studies, evaluated with the Jadad score, is reported in Supplementary Table S1. Most of the studies (13 out of 20), reported a score greater than or equal to 3, which is the minimum score for an article to be considered of great quality.

The eligible studies were composed of intervention strategies that lasted from 1 month to 1 year, and which considered from low-intensity to moderate-intensity exercise protocols. The duration and type of intervention, the intensity and the frequency of the exercise protocols are reported in Table 1.

### Methods to improve QoL in RCF older people: physical activity as a wide intervention

Several studies tried to assess the effects of physical activity on RCFs older adults' functional mobility and physical skills.<sup>31–43</sup> As result, 7 of the included studies demonstrated that low-intensity physical activity can improve RCFs older residents' functional capacity.<sup>31–33,35,36,42,43</sup> Moreover, moderate-intensity physical activity was proven to be effective in 3 studies.<sup>34,39,41</sup> However, in 3 studies, neither low intensity nor moderate physical activity changed the physical functions of RCFs residents recruited in the projects.<sup>37,38,40</sup>

Interestingly, not only the functional limitations of older residents were modified by physical interventions proposed in RCFs, but also some other determinants of their QoL, as balance, anxiety and depression, the capacity to perform daily activities, life satisfaction, body pain, fear of falling, loneliness feeling, autonomy, and social support. Several studies evaluated the physical intervention effects on modulating balance on older adults of RCFs,<sup>31–33,35,36,40,41,44,45</sup> finding that low-intensity physical activity protocols induced great improvement in balance index,<sup>31–33,35,40,44,45</sup> and in postural stability.<sup>45</sup> Strength and balance exercises, legs and knees extension exercises, balancing/

**Table 1**  
Physical activity and multidimensional interventions tested in residential care facilities (RCFs)

Exercise Type	Citation	Protocol design	Duration	Frequency	Intensity	QoL-related factors assessed	Questionnaires and tests administered	Results in the intervention group
Low Intensity	Alvarez-Barbosa et al. [43]	Supervised whole-body vibration exercise	8 weeks	3 s/wk	n.r.	Functional mobility; muscle performance; postural stability; autonomy; daily activities; anxiety and depression	- Time Up and Go test - 30 s Chair Sit to Stand test - Barthel Index - EuroQoL test	Improved: - TUG test $p < 0.001$ - 30 s CSTS number of times $p = 0.006$ - EQ-5D mobility $p < 0.001$ - EQ-5D utility $p < 0.001$ - Barthel Index $p = 0.003$
	Pereira et al. [36]	Multimodal section exercises promoting motor and cognitive stimulation.	10 weeks	2 s/wk	n.r.	Planning ability; lower body strength; agility; balance; mobility	- Tower of London test - 6 min walk test - 30 s chair stand test - 8-foot up-and-go test - Performance-oriented mobility	Improved: - Planning ability; selective attention $p < 0.05$ - Lower body strength $p < 0.05$ - Agility $p < 0.05$ - Balance $p < 0.05$ - Mobility $p < 0.05$
	Arrieta et al. [31]	Multicomponent exercise involved strength, balance, stretching exercises and walking recommendations	3 months	2 s/wk	40–60% 1RM	Bilateral handgrip strength; functional mobility; balance	- Senior Fitness Test, Short Physical Performance Battery, bilateral handgrip strength test, fast 4-meter walking speed, and static balance	Improved: - Short Physical Performance Battery $p < 0.001$ - Gait speed $p < 0.01$ - Berg scale score $p < 0.05$ Performance in the remaining parameters was maintained.
Low Intensity	Baum et al. [32]	Seated range of motion exercises and strength training	1 year	3 s/wk	n.r.	Functional mobility; balance; cognitive status	- Timed get-up-and-go test - Berg balance scale - Physical performance test	Significant overall impact across all the measures assessed $p < 0.013$
	Calcar et al. [45]	Combined exercise program: stretching, strength and aerobic exercises + jumping session	6 weeks	3 s/wk	n.r.	Balance; depression and anxiety; body pain; postural stability	- Mini-mental status exam - Berg balance test - Short-form 36 test - Geriatric Depression Scale	Improved: - Balance $p = 0.02$ - Overall postural stability $p = 0.03$ Health-related QoL and depression status did not change
	Chen et al. [46]	Yoga	24 weeks	3 s/wk	n.r.	Sleep quality; depression and anxiety	- Pittsburgh Sleep Quality Questionnaire	Improved: - Depression state $p = 0.002$ - Total sleep quality score $p = 0.005$ - Sleep disturbances $p < 0.001$
	Cichoński et al. [37]	20 units of low-intensity physical activities, including balance, coordination, strength and postural exercises	20 weeks	1 s/wk	n.r.	Daily activities; anxiety and depression; body pain; life satisfaction; functional mobility; cognitive status	- Euro Quality of Life-5D - Visual analog rating scale for pain perception - Timed Up and Go Test, Chair Sit and Reach, Lower Back Scratch - Mini-Mental State Examination	Improved: - Health status (EQ-5D) $p = 0.001$ - Self-rated health $p = 0.001$ Anxiety and depression, body pain, cognitive status, and functional mobility did not change
Low Intensity	Gusi et al. [44]	Balancing/rebalancing and postural stability exercise with or without visual feedback, and weight shift exercise.	12 weeks	2 s/wk	n.r.	Fear of falling; dynamic balance; isometric strength	- Falls Efficacy Scale International questionnaire - Fall Risk Test - Torque of knee flexor and extensor; isometric strength measured with an isometric dynamometer	Improved: - Fear of falling $p < 0.001$ - Dynamic balance $p < 0.001$ - Isometric strength $p < 0.001$
	Lam et al. [35]	Strength and balance program combined with whole-body vibration	8 weeks	3 s/wk	n.r.	Functional mobility; balance; lower limb strength	- Timed Up and Go Test - Berg Balance Scale - Five-times-sit-to-stand test - 6 min walk test - Activities-specific Balance Confidence Scale	Improved: - lower limb strength $p = 0.048$ - balance $p = 0.033$

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Table 1 (Continued)

Exercise Type	Citation	Protocol design	Duration	Frequency	Intensity	QoL-related factors assessed	Questionnaires and tests administered	Results in the intervention group
Low Intensity	Mouton et al. [42]	Giant exercising board game to perform strength, flexibility, balance and endurance activities	1 month	2 s/wk	n.r.	Functional mobility; daily activities; autonomy; balance	- Steps/day and energy expenditure - Mini-mental state examination - EuroQol 5D - Behavioral Regulation in Exercise Questionnaire-2 - Tinetti and Short Physical Performance Battery - Timed up and go and muscular isometric strength - Timed-up-and-go test - Late-life satisfaction index - SF-36 test	Improved: - Functional mobility $p = 0.04$ - Energy expenditure/day (+6.3%; +12.3% after 3 months) $p = 0.01$ ; $p = 0.02$ - Quality of life $p = 0.05$ - Balance and gait $p = 0.05$ - Strength of the ankle after 3 months $p = 0.05$ Autonomy did not change Improved SF-36 total physical component summary after 3 months $p = 0.022$ No difference in mobility and life satisfaction measures at any time, nor any measures at 6-month follow-up.
Resistance and aerobic exercise	Peri et al. [38]	Individualised functional goal-setting program	6 months	1 s/wk	n.r.	Functional mobility; life satisfaction; depression and anxiety; body pain		Improved: - Functional mobility $p = 0.02$ - Capacity to perform daily tasks $p = 0.05$ - Hand-grip strength $p = 0.044$ - Balance $p = 0.044$ Improved: - Life satisfaction $p = 0.08$ - Perception of loneliness $p = 0.08$ Activities of daily living were unchanged Other data were contradictory in some cases, as the functional abilities worsened in both groups.
Isometric exercise	Benavent-Caballer et al. [33]	Legs and knees extension exercises	4 months	3 s/wk	40% 1RM	Functional mobility; balance; daily activities	- Timed get-up-and-go test - Berg Balance Scale - 6 min walk test - Barthel Index	Improved: - Functional mobility $p = 0.02$ - Capacity to perform daily tasks $p = 0.05$ - Hand-grip strength $p = 0.044$ - Balance $p = 0.044$ Improved: - Life satisfaction $p = 0.08$ - Perception of loneliness $p = 0.08$ Activities of daily living were unchanged Other data were contradictory in some cases, as the functional abilities worsened in both groups.
Other	Tse et al. [47]	Gardening program	8 weeks	1 s/wk	n.r.	Life satisfaction; loneliness; daily activities	- Life Satisfaction Index-A Form - Revised UCLA Loneliness Scale - Modified Barthel Index - Lubben Social Network Scale - Berg Balance Scale - Timed Up and Go Test - Barthel Index - EQ-5D - Nursing Home Falls Self-Efficacy Scale	Improved: - State self-esteem - SF-12 total physical and mental component summary across the 26-week study period $p = 0.02$ No significant changes in social support Improved: - Depression and anxiety (levels after 12 and 24 weeks of intervention $p = 0.04$ and $p = 0.01$ ) Improved: - Cognitive abilities $p < 0.001$ - Autonomy $p < 0.001$ Slight decline in the measurements obtained 10 weeks after the intervention approaches
Moderate Intensity	Lee et al. [39]	Tai chi	26 weeks	2 s/wk	n.r.	Self-esteem; life satisfaction; social support; functional mobility	- State Self-Esteem Scale - SF-12 Health Survey - Social Support Questionnaire Short Form - Satisfaction with the Nursing Home Instrument	Improved: - State self-esteem - SF-12 total physical and mental component summary across the 26-week study period $p = 0.02$ No significant changes in social support Improved: - Depression and anxiety (levels after 12 and 24 weeks of intervention $p = 0.04$ and $p = 0.01$ ) Improved: - Cognitive abilities $p < 0.001$ - Autonomy $p < 0.001$ Slight decline in the measurements obtained 10 weeks after the intervention approaches
	Vernasio et al. [48]	Exercise and music therapy	28 weeks	2 s/wk	Not exceed 75% maximum pulse rate	Depression and anxiety	- Geriatric Depression Scale - Hamilton Anxiety Scale	Improved: - Depression and anxiety (levels after 12 and 24 weeks of intervention $p = 0.04$ and $p = 0.01$ ) Improved: - Cognitive abilities $p < 0.001$ - Autonomy $p < 0.001$ Slight decline in the measurements obtained 10 weeks after the intervention approaches
	Hagen et al. [49]	Exercise and music therapy	10 weeks	3 s/wk	n.r.	Cognitive status; daily activities; autonomy; life-satisfaction; functional mobility	- Cognitive assessment scale - Behavior rating scale - Overall dependency scores - Life satisfaction index - Physical assessment	Improved: - Cognitive abilities $p < 0.001$ - Autonomy $p < 0.001$ Slight decline in the measurements obtained 10 weeks after the intervention approaches

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Table 1 (Continued)

Exercise Type	Citation	Protocol design	Duration	Frequency	Intensity	QoL-related factors assessed	Questionnaires and tests administered	Results in the intervention group
Moderate Intensity Resistance and aerobic exercise	Hewitt et al. [34]	Individually prescribed progressive resistance training and balance exercise	25 weeks	2 s/wk	Self-described as 12–14 in Borg Scale	Functional mobility; depression and anxiety; body pain; fear of falling; cognitive status	<ul style="list-style-type: none"> <li>- Short Physical Performance Battery</li> <li>- 36-item Short-Form Health Survey and the EuroQoL-5 Dimensions-5 Levels</li> <li>- Life-Space Assessment</li> <li>- Falls Efficacy Scale-International</li> <li>- Addenbrooke's Cognitive Examination- Revised</li> </ul>	<p>Reduced rate of falls (–55%)</p> <p>Improved physical performance <math>p = 0.02</math></p> <p>Other parameters assessed did not change</p>
Moderate Intensity Resistance and aerobic exercise	Taguchi et al. [41]	Exercises related to flexibility, muscle strength, balance, and aerobic performance.	12 months	1 s/wk	1.8–3.0 METs (light-to-moderate)	Muscle strength; balance; flexibility; depression and anxiety; functional mobility	<ul style="list-style-type: none"> <li>- Lower-limb and grip strength</li> <li>- Timed 1-legged standing with open eyes</li> <li>- Sit-and-reach test</li> <li>- 6-minute walking distance</li> <li>- Instrumental Activities of Daily Living, Mini-Mental State Examination, Philadelphia Geriatric Center: Morale Scale, Geriatric Depression Scale, Gerontology Index of competence, and the Falls Efficacy Scale</li> </ul>	<p>Improved:</p> <ul style="list-style-type: none"> <li>- Lower-limb strength <math>p = 0.004</math></li> <li>- Grip strength <math>p &lt; 0.001</math></li> <li>- Functional mobility <math>p = 0.022</math></li> </ul> <p>No clear differences in other factor measurements or changes in physical activity were detected</p>
Moderate Intensity Resistance and aerobic exercise	Huang et al. [50]	Exercise and cognitive-behavioral strategies	8 weeks	2 s/wk	Self-reported as 12–13 on Borg scale	Fear of falling; daily activities; functional mobility; balance; muscle strength	<ul style="list-style-type: none"> <li>- Geriatric fear of falling measure and falling efficacy scale</li> <li>- Falls Efficacy Scale</li> <li>- Falls Record Checklist</li> <li>- Taiwanese depression questionnaire</li> <li>- Tinetti Mobility Scale</li> <li>- Micro FETZ</li> </ul>	<p>Reduced rate of falls <math>p &lt; 0.001</math></p> <p>Improved:</p> <ul style="list-style-type: none"> <li>- Depression level <math>p &lt; 0.05</math></li> <li>- Functional mobility <math>p &lt; 0.05</math></li> <li>- Muscle strength <math>p &lt; 0.05</math></li> </ul> <p>Balance did not change</p>

s/wk: sessions per week; n.r.: not reported; IRM: One Repetition Maximum; METs: Metabolic equivalent of task

rebalancing and postural stability exercises, or body vibration exercises represented the physical activities proposed in these studies. On the other hand, multimodal section exercises promoting motor and cognitive stimulation<sup>36</sup> and moderate-intensity exercises related to flexibility, muscle strength, balance, and aerobic performance<sup>41</sup> did not change the balance index of the participants.

The effects of physical activity in modulating anxiety and depression levels in RCFs older adults was considered by 7 different studies,<sup>34,37,38,40,41,45,46</sup> 5 of which demonstrated no correlations between low-intensity exercises (balance, coordination, strength and postural exercises, or supervised whole-body vibration exercises) or moderate-intensity exercises (flexibility and balance exercises) and the decreased level of anxiety and depression.<sup>34,37,40,41,45</sup> Only Yoga and an individualized functional goal-setting program were able to improve this QoL-related aspect in older adults living in RCFs.<sup>38,46</sup> Moreover, Yoga induced an improvement in the participants' sleep quality, too.<sup>46</sup>

Physical activity at the oldest age could be helpful in improving the capacities of RCFs residents to perform daily activities, increasing their autonomy, too. These two QoL-related aspects were assessed in 8 different studies,<sup>33,36,37,42,43,46–48</sup> 4 of which confirmed the positive effects of multimodal section exercises or balance, coordination, strength and postural exercises in improving the ability of older residents to perform their daily activities.<sup>33,36,37,42</sup> Interestingly, Mouton and colleagues showed that the giant exercising board game proposed in their study to perform strength, flexibility, balance and endurance activities was able to positively impact RCFs older adults' capacities, but not their autonomy level.<sup>42</sup>

Another important QoL-related aspect considered by different studies was the older adults' life satisfaction level;<sup>37–40,47</sup> results showed that it was positively affected by low-intensity physical activities, as gardening, dancing and walking in groups, which also decreased the loneliness-perceived level,<sup>37,47</sup> but also by moderate-intensity sessions of Tai Chi,<sup>39</sup> which positively modulate RCFs older adults' self-esteem, too. On the other hand, an individualized functional goal-setting program and a podiatry intervention were not able to impact the life satisfaction of older adults recruited in the studies.<sup>38,40</sup>

Body pain is another QoL-related factor considered in different eligible studies.<sup>34,37,38,40,45</sup> Unfortunately, only the individualized functional goal-setting program proposed by Peri *et al.* gave some positive effects on the body pain perceived by the RCFs older residents.<sup>38</sup>

Lastly, the modulation of the fear of falling given by physical activity was assessed by two different studies.<sup>34,44</sup> As result, the fear of falling decreased in older adults performing individually prescribed progressive resistance training and balance exercises,<sup>34</sup> and balancing/rebalancing and postural stability exercises.<sup>44</sup>

#### Multidimensional intervention programs in RCFs

The effects of multidimensional approaches in modulating QoL or QoL-related aspects in older adults living in RCFs were tested by few authors,<sup>48–50</sup> and the protocols proposed in all these studies considered moderate-intensity exercises (Table 1). Interestingly, functional mobility improved in all the eligible studies.<sup>48–50</sup> The capacity of the older residents to perform daily activities was affected neither by the exercise and music therapy protocols proposed by Hagen and colleagues<sup>49</sup> nor by an exercise and cognitive-behavioral strategies intervention proposed by Huang and colleagues.<sup>50</sup> On the other hand, the same protocol statistically decreased the older residents' fear of falling and their anxiety and depression levels,<sup>50</sup> which was strongly affected by the exercise and music therapy proposed by Verusio *et al.* in a group of depressed older adults, too.<sup>48</sup> Interestingly, the results obtained were greater than those obtained with

pharmacological treatments, the older adults were more physically active at the end of the study, and results seemed to be persistent over time.<sup>48</sup>

Lastly, Hagen and colleagues demonstrated that the intervention assessed in their article was able to improve life satisfaction and autonomy levels in the recruited older adults of the intervention group;<sup>49</sup> this aspect was not considered by other authors.

#### Different outcomes according to the intervention characteristics

Most of the studies included in this review proposed low-intensity physical activity protocols; however, only in 2 out of 14 articles, the intensity of the exercise was effectively measured and mentioned.<sup>31,33</sup> The same defect is present in the articles that proposed moderate-intensity exercises: only 2 out of 6 measured and reported the intensity of the exercises,<sup>41,48</sup> 2 out of 6 registered self-reported intensity given by the participants according to the Borg Scale<sup>34,50</sup> and 2 out of 6 did not measure exercises intensity.<sup>39,49</sup>

Evaluating the study interventions that were performed with a frequency of 3 sessions per week and that lasted at least 8 weeks, all of them modulated all the QoL-related aspects considered by authors: functional mobility, balance, capacity to perform daily activities, autonomy e life satisfaction.<sup>32,33,35,43,46,49</sup> Conversely, in the studies with the same sessions' frequency (3 sessions per week), but with a shorter duration of the project, the balance and postural stability of the intervention group increased, but not functional mobility and anxiety level.<sup>45</sup>

Furthermore, decreasing the frequency of the sessions performed by RCFs older adults during the intervention strategies, results are not so clear: the interventions that considered 2 sessions per week and that lasted a minimum of 8 weeks led to improved functional mobility,<sup>31,34,36,39,44,48,50</sup> but some of them did not modulate the balance<sup>36,50</sup> or anxiety and body pain.<sup>44</sup> Moreover, the interventions that proposed one session per week did not improve the functional mobility and the capacity of RCF older adults to perform daily activities, even though in protocols that lasted 24 weeks. With a frequency of 1 session per week, only 48 weeks of intervention improved the functional mobility of the RCFs older adults.<sup>41</sup>

Interestingly, independently of the frequency and the duration of the intervention, all the moderate-intensity exercises proposed gave an improvement on the functional mobility of the RCFs older adults. Moreover, considering the multidimensional approaches, not only the functional mobility improved, but also other factors related to the psychological aspect of the older residents, like anxiety, depression, empowerment, self-esteem, and life satisfaction, in all the eligible studies.<sup>48–50</sup>

#### Discussion

To our knowledge, this is the first systematic review aiming to identify physical activity and multidimensional interventions performed in RCFs to improve older adults' QoL. The results from the 20 included articles would suggest that the multidimensional approaches strongly positively affect QoL and QoL-related aspects of the older residents of the intervention group and indicate the importance of interventions targeting staff and caregivers' working methods, too.

Most of the studies were published in the last 10 years, suggesting the novelty of the interest in this field, and justifying the limited available literature about these arguments. Importantly, 7 out the 20 eligible articles scored only 1 or 2 on the Jadad scale, deeming to be of poor methodological quality, which, along with the low number of the included studies and the differences between the protocol designs proposed in the projects, make the results to be treated with caution.

Nevertheless, the fact that physical frailty and the decrease in functional mobility increase exponentially the risk of activity limitation is a well-known danger for older adults, compromising their independent living and limiting their health-span, too. To counteract the physiological physical frailty and the decreasing of physical functions, one of the most proposed interventions in RCFs is physical activity. To study and propose this type of intervention, the WHO recommendations have to be considered, in particular those postulated for adults aged 65 and above.<sup>17</sup> Particularly, it is essential to remember that in this group of people physical activity comprises leisure-time physical activities, too, and it that this type of intervention could give results more impactful than the mere improving coordination or physical skills.

Several studies evaluated the benefits of physical activity on reducing the risk of functional limitations in RCFs older adults, showing significant improvement in the movements and the capacity to perform daily activities in the older residents who are more active, decreasing depression levels, sleep disturbances and daytime dysfunctions.

Interestingly, not all the protocols considered improved the same QoL-related factors. Data showed that the projects that proposed a longer period of interventions and a high frequency of the exercise sessions (3 sessions per week) led to the best results, improving all the aspects of the QoL considered in the studies.

Importantly, low-intensity protocols can induce these effects, too, opening the possibility to perform low-intensity aerobic and resistance exercises in RCFs that can be effective in ameliorating residents' wellbeing; considering the inability of most of the older residents to reach high intensities during their activities, these results highlight the great effectiveness of the physical activity, in the most frailty population, too.

However, the main difficulty in proposing physical activity interventions to RCFs adults is given by the lack of a standardized definition and measure of low and moderate intensity of the exercise for this subpopulation. For example, moderate-intensity physical activity is mostly defined as the movement that causes a noticeable increase in heart rate and breathing effort, but in the older adults' population the maximal heart rate decreases with age and it could be affected by many cardiac medications.<sup>51</sup> Hence, using heart rate as a measure of intensity of the physical activity in older adults can be problematic and of difficult interpretation. Another method to measure physical activity intensity is the Borge scale, which considers the perceived exertion during the physical activity session. It is based on the physical sensations a person experiences during physical activity, including increased heart rate, respiration rate, sweating, and muscle fatigue, and it is widely used in older people. However, it is a subjective measure, and it can be affected by different physiological conditions in the older population.

Most importantly, physical activity intervention programs can induce both social and environmental modifications, in addition to positive changes in older adults' physical performances. Multidimensional approaches in RCFs were considered by only a few authors, who found out reduced anxiety, depression levels and behavioral difficulties, improved cognitive abilities and life satisfaction in older people who performed music and exercise sessions, and exercise and cognitive-behavioral exercises.<sup>48–50</sup> Based on the findings, an example ideal program would include an intervention in which a multidimensional approach is proposed, to lead to the improvement of different determinants of older adults' QoL.

Furthermore, an approach including training strategies for the staff members is essential to obtain the maximal older adults' empowerment. Some studies emphasized the importance to perform seminars with caregivers, which concerns different contents, such as well-being, communication, individualized care plans, and development of an improvement plan.<sup>52,53</sup> Authors showed that the approaches

suggested during the seminars resulted in higher empowerment, improved capacity to perform daily activities, a more person-centered and safer climate for the RCFs older people; furthermore, a higher level of life satisfaction and a decreased anxiety and depression were shown, too;<sup>52</sup> moreover, their functional mobility and physical capacities improved, and their loneliness level decreased.<sup>53</sup>

Caregivers' ability to create a relationship based on confidence with the residents may be useful to be trusted by them; identifying RCF older adults' difficulties, possibilities, weaknesses, and strengths, can stimulate them to overcome their fears.

Lastly, the use of new technologies could ameliorate social networking and cooperation, physical abilities, memory, mobility, and impact the autonomy in older adults' daily activities. This approach lets the RCFs' residents interact with each other, gaming together, encouraging body movement, increasing their physical skills and mental stimulation. Even though this approach seems to be very promising and useful, only one article considered this type of project in RCFs.<sup>42</sup>

## Conclusions

Physical activity and multidimensional interventions can be the best strategy to improve RCF older adults' QoL, letting them participate in different activities, preferring the group ones to enhance collaboration and social interactions. All these interventions would improve the cognitive functions of RCFs older adults, stimulating their memories and letting them feel self-satisfied and the effects seem to be constant over time. An intervention in RCFs must avoid the passive survival of residents and develop their residual capacities, maintaining their independence for as long as possible. It would, therefore, be important not only to treat RCFs older adults' functional deficits but also to assist them as a whole and uniqueness, trying to offer them conditions that could transform the so-called "vicious circle of not self-sufficiency" into a "virtuous circle of self-satisfaction and autonomy".

In conclusion, based on the findings, we can hypothesize that an ideal intervention concerning physical activity alone would be a program proposing the highest frequency of 3 sessions per week, and lasting more than 8 weeks. Moreover, we can assume that moderate-intensity exercise in multidimensional approaches can be the most effective strategy in improving the QoL of older adults living in RCFs.

Unfortunately, the differences in the approaches proposed in the included articles, the lack of intensity measurement in most of the included studies, and the small number of the studies found made an interpretation of the results difficult and uncertain. This leads to a strong need for standardized and well-designed physical intervention programs for RCFs older adults, concerning multidimensional approaches to improve different aspects of QoL in RCFs adults. The importance of social-relational dimension that can be assumed by physical activity and technology interventions must be considered and included in the care programs for RCFs residents. Tailored physical activity protocols have to be planned for older adults, considering their physiological decline and age-related limitations. Moreover, assessing the intensity of the physical activity will be essential, to understand which is the best strategy, to optimize the beneficial effects of physical activity in RCFs older residents. Lastly, standardized caregivers' training processes would be necessary, increasing their awareness, and implementing care plans that can be shared at a national level.

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## Author Contributions

Conceptualization: G.Ba, M.D.S and G.Br; writing-original draft preparation: G.Ba and M.D.S; writing-review and editing: G.Ba, M.D.S and G.Br; supervision: G.Br and F.D.F.

## Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.gerinurse.2021.04.011.

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