

Research Article

Health-Related Quality of Life Improvement in Residential Care Facilities' Elders through a Physical Activity Program

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Epidemiological data show that people are living longer. This change carries opportunities for people but also the increased need of residential care facilities (RCFs) for older adults who require care that cannot be taken at home. The entry in RCFs is a delicate moment, in which maintaining autonomy is essential, along with promoting physical and mental health. The aim of this work was to evaluate the perceived quality of life (QoL)-related variables in RCFs residents at the baseline and after a 6-week physical activity (PA) intervention, to explore its possible role in improving the older adults' perceived QoL. Overall, 108 residents belonging to seven Italian RCFs were enrolled. The Short-Form 12 (SF-12) questionnaire was used to assess the Physical Component Score (PCS) and Mental Component Score (MCS). To evaluate the residents' attendance at PA, questions about weekly frequency of PA performed were included, analyzing data also considering the presence of a kinesiologist as a member of the RCF team. After baseline assessments, a 6-week PA intervention conducted by a kinesiologist was implemented in 2 RCFs and then the same variables considered at the baseline were reevaluated. As expected, the residents' PCS resulted inversely related to their age. The individual PA attendance and the MCS were greater in older adults living in RCFs where a kinesiologist was present. Moreover, the higher adherence at individual and group PA was related to higher MCS only. After the 6-week PA intervention, a greater RCFs residents' attendance at individual PA and a high frequency in group activities were shown. Furthermore, the program improved both MCS and PCS of the participants. Data suggest the strong impact of PA, structured by an expert, in increasing the health-related variables in RCFs' older residents, especially the mental sphere of the perceived QoL. These beneficial effects were shown particularly with the twice-a-week program.

1. Introduction

Epidemiological data show that people are living longer; by 2050, the world's population aged 60 years and older is expected to reach 2 billion, representing the 22% of the entire population [1]. The UN General Assembly declared in December 2020 the Decade of Healthy Ageing (2021–2030), a global initiative consisting of ten years of concerted, catalytic, and sustained collaboration in which older people are the focus, and which brings together the efforts of governments, civil society, international agencies, and

private sector to improve the lives of older people, their families, and communities [2]. By the end of the period concerned in this initiative, the number of people aged 60 years and older will be 34% higher than today, increasing up to 1.4 billion [3]. Longer lives are one of our most remarkable collective successes. This suggests advances in social and economic development as well as in health, specifically the achievement in dealing with fatal childhood illness and, more recently, mortality at older ages. A longer life is an extremely valuable resource: it provides the opportunity to rethink not just what older age is but also how

our whole lives might evolve. The population ageing will keep affecting every aspect of society, including the demand for goods and services, such as health, long-term care, social protection, transport, as well as family structures.

A significant decline in physical and mental abilities can limit older people's autonomy to care for themselves and to participate in society; in this sense, access to long-term care facilities, with assistive technologies and supportive, inclusive environments, can improve the situation [4, 5]. The entry into good-quality long-term care is essential for such people, to maintain their functional ability, enjoy basic human rights, and live with dignity. To these purposes, one of the actions proposed by the UN General Assembly for the Decade of Healthy Ageing was to ensure innovative digital and assistive technologies to improve the functional ability and well-being of older people living in long-term care facilities and to monitor the quality of long-term care, assessing their capacity to improve functional ability and well-being of the residents [2].

The well-being notion totally fits in the quality of life (QoL) broad-ranging concept, whose key objective in older population is to permit an active and healthy ageing, to maintain autonomy and independence, promoting physical and mental health, social inclusion, in need-of-care people, too. For these reasons, the main objective of caring for older people should be proposing comprehensive care, considering the environment in which older people find themselves, allowing a meaningful life in the period of older ages [6]. Previous works have demonstrated that for institutionalized individuals, maintaining autonomy and a good physical, mental, and social health is crucial and that this goal can be achieved through a multidisciplinary approach, which includes multicomponent physical activity (PA) programs, too [7]. Particularly, several studies disclosed that the frequency of the performed PA sessions seems to be related to the efficacy of the intervention strategies. Different interventions that concerned 3 sessions per week were able to modulate all the QoL-related aspects considered by authors: functional mobility, autonomy, and life satisfaction [8–10]. Decreasing the frequency to 2 sessions per week, different studies stated an improved functional mobility [11–13] and mental health [14], while some interventions that proposed one session per week were not sufficient to ameliorate the functional mobility of the Residential Care Facilities (RCFs) older adults but improved the health status [15, 16].

1.1. Aim of the Study. Starting from these considerations, the main goal of this study was to assess the perceived QoL of residents living in some RCFs of central Italy, analyzing the PA levels performed by residents, in presence or absence of a PA expert (hereafter kinesiologist) as a member of the RCF staff. Moreover, as the secondary aim, PA attendance was assessed after 6 weeks of intervention program led by a kinesiologist in the RCFs in which this specific figure lacked before the intervention period. Particularly, mental and physical statuses were measured at the baseline and after the kinesiologist's program by a specific questionnaire; the aim of our study was to find possible correlations between the modifications in health-related variables and the change

in the residents' PA attendance. The data obtained by this project could help define the real impact of a PA program in RCFs residents' perceived-QoL.

2. Materials and Methods

2.1. Study Design. In this study, we analyzed the perceived-QoL of RCFs residents and its association with their individual and in group PA attendance. The present work was a multicenter study carried out in RCFs belonging to Marche and Emilia Romagna Regions (Italy), between January 2021 and December 2022. The providers of the RCFs were contacted and asked to participate in the study; then, a meeting was organized with facility managers who indicated their interest in the study. Researchers proposed methods to evaluate the health-related variables and the PA attendance, which were agreed upon by the facility before the beginning of the project. The intervention PA program to be proposed in RCFs were discussed and approved by the RCFs manager, too.

2.2. Inclusion Criteria. The criteria for inclusion for the participants were age greater than 65, residence at the facility, the ability to ambulate, and the exemption from therapies that may affect the cognitive capacities. RCF residents were asked to participate after an individual interview in which the project and the purpose of the study were explained in detail; after that, the informed consent document was signed by the RCF residents in the presence of only the RCF manager. Then, the researchers received a list with the codes assigned to each resident, in order to perform a privacy-accordant and blind work.

2.3. Residential Care Facilities. Seven RCFs were included in the study (5 from Marche and 2 from Emilia Romagna regions). In three out of seven RCFs, a kinesiologist was a member of the interdisciplinary health care team, promoting individual and group PA sessions to the residents and proposing individual and group sessions of PA, composed by 10–20 participants, at least twice a week. These RCFs had a gym inside the building, and PA was administered by a qualified kinesiologist, expert in adapted exercises and specialized in carrying out PA programs suitable for older adults. Individual and group PA sessions lasted from 20 to 40 minutes, respectively, and were composed as follows:

- (1) An initial warm-up phase characterized by aerobic exercises (walking and stepping) and general mobility
- (2) A tone-up phase with coordination, strength, and dynamic and static balance exercises
- (3) A cool down final part focused on stretching and relaxing exercises.

Conversely, in RCFs without a kinesiologist as a member of the staff, general advice on the beneficial effects of PA was given to older adults by nurses or educators, who tried to

involve the participative older adults primarily in group movement sessions, at least once a week. This second group of RCFs did not have a specific place where to perform PA sessions, and the activities were mainly performed in a common room or outside.

2.4. Ethical Aspects. The study was approved by the Ethical Committee for Human Experimentation of the University of Urbino Carlo Bo (permission number: 29/April 22, 2020). An integration application was then asked to include also RCFs of the Emilia Romagna region and was obtained on September 30, 2021 (permission number: 49/September 30, 2021).

2.5. Health-Related QoL Variables' Measurement. In order to assess the RCFs residents' mental and physical health as QoL-related factors, the 12-Item Short-Form (SF-12) Health Survey was used [17]. The questionnaire was filled out by the residents, together with an operator who read and explained each question and related options to answer. The data from the 12 questions of the SF-12 questionnaire can be grouped into 1 of 8 separate health domains: general health (GH), physical functioning (PF), physical role (PR), emotional role (ER), bodily pain (BP), vitality (VT), mental health (MH), and social functioning (SF). These 8 health domains are further reduced to a physical component score (PCS) and mental component score (MCS) [18]. The results were analyzed according to the algorithm proposed by Ware et al. in which the reference PCS and MCS (PCSref and MCSref) are related to the age of the target population [17].

2.6. Physical Activity Measurement. With the aim to assess the RCF residents' attendance at the proposed PA, the frequency of individual and group PA sessions performed by RCFs' residents was assessed, including specific questions. Particularly, each RCF resident's self-reported weekly attendance at individual and group PA was investigated, including four possible answers: never; rarely; once a week; more than once a week. In addition, we asked participants to give information related to the PA type (i.e., individual and group).

2.7. Physical Activity Interventional Program. In two RCFs belonging to Marche Region in which the kinesiologist was not present at the baseline data acquisition, a 6-week interventional program with a kinesiologist was proposed, at the end of which the SF-12 questionnaire and the PA measurement questions were asked again. Thirty-six residents, who belonged to two out of the 5 RCFs without a kinesiologist, were involved in the PA program, participated in the intervention and to the posttest assessments.

The PA program was supervised by a kinesiologist, and it was characterized by light-to-moderate intensity exercises. The sessions were delivered once or twice per week, both in individual and group. The individual session lasted 20–25 minutes, and it was characterized by active and passive mobility exercises for the lower limbs, lumbar-

cervical spine, and upper limbs. Muscle strengthening exercises for lower and upper limbs performed using small dumbbells, sticks, elastic bands, balls, and anklets. Walking exercises combined with natural weight balance activities were used to strengthen the lower limbs. The group session (10–20 participants) lasted 30–40 minutes, and it was characterized by an initial phase based on mobility and coordination exercises using small equipment (i.e., balls, sticks, tennis balls, and hoops) mainly in a seated position. Then, participants performed couple dance activities with trainers.

2.8. Statistical Analysis. Statistical analysis included *t*-test to ensure the homogeneity of the groups on baseline age (residents living in RCFs with or without the kinesiologist). Moreover, *t*-test was also used to assess if the presence of a kinesiologist in the facilities at the baseline can affect the PCS and MCS of the residents. To assess the differences between the baseline attendance at individual or group PA, in RCFs with or without PA, the kinesiologist, the intergroup analyses were conducted using chi-square statistics. Furthermore, the differences in PCS and MCS according to the attendance at individual or group PA at the baseline were evaluated by 1-way ANOVA followed by Dunnett's multiple comparison test. Furthermore, Spearman's coefficients were calculated to find correlations between PCS and MCS with age, attendance at individual PA, and attendance at group PA. In addition, multiple linear regression with backward stepwise elimination was conducted using the variance between the population reference score (MCSref or PCSref) according to the age of the subjects [17] and the score obtained by SF-12 for each older adult participant (delta PCSref; delta MCSref). Predictors were age, attendance at individual PA, and attendance at group PA. Lastly, paired *t*-test was used to evaluate the effects of the PA intervention on residents' attendance at the activities proposed and to evaluate changes in PCS and MCS results before and after the intervention (preposttest). Statistical analysis was performed using GraphPad and SPSS software.

3. Results

3.1. Characteristics of Participants. Ten residents out of 130 potential participants did not meet the inclusion criteria, 10 declined to participate, and two did not sign the informed consent document, leaving 108 participants. The descriptive characteristics of the participants are summarized in Table 1. Among the participants, three-fourths ($n = 84$, 77.8%) were female. Overall, the participants had a mean age of 84.4 (SD 7.9, range 66–103); moreover, the mean age of older adults of RCFs with or without a kinesiologist was not significantly different ($p = 0.714$).

Evaluating the baseline attendance at the individual PA, 48.1% of the total population performed this type of activity; particularly, the attendance was significantly higher in RCFs with a kinesiologist than in RCFs in which this professional figure was not included in the staff (36/41 vs. 16/67; 87.8% vs. 23.9%). Moreover, 70.4% of the participants affirmed

TABLE 1: The participants' characteristics and attendance at individual and group PA.

	Total sample (N = 108)	RCFs with kinesiologist (N = 41)	RCFs without kinesiologist (N = 67)	p value
Age (years \pm SD)	84.4 \pm 7.9	84.0 \pm 8.9	84.7 \pm 7.3	0.714 ^a
Women (N)	85.8 \pm 7.2 (84)	85 \pm 8.5 (32)	86.2 \pm 6.3 (52)	0.484 ^a
Men (N)	79.8 \pm 8.6 (24)	80.7 \pm 10.0 (9)	79.2 \pm 8.0 (15)	0.713 ^a
<i>Individual PA, N (%)</i>				
Yes	52 (48.1%)	36 (87.8%)	16 (23.9%)	
No	56 (51.9%)	5 (12.2%)	51 (76.1%)	<0.001 ^b
<i>Group PA, N (%)</i>				
Yes	76 (70.4%)	29 (70.7%)	47 (70.1%)	
No	32 (29.6%)	12 (29.3%)	20 (29.9%)	0.949 ^b

^at-test; ^bchi-square; PA: physical activity.

participating in the group PA sessions; in this case, the percentage of the older adults who performed PA was similar in RCFs with or without a kinesiologist (70.7% vs. 70.1%, respectively) (Table 1).

3.2. Mental and Physical Health Measures at the Baseline. The assessment of SF-12 questionnaire results showed a significantly higher MCS in the older adults living in RCFs with the kinesiologist than in RCFs without the professional figure (50.2 \pm 11.3 and 45.7 \pm 7.8, respectively); conversely, the mean PCS was not affected by the presence of the kinesiologist (Figure 1(a)). Moreover, considering the type and the attendance at PA, the MCS resulted in being related to individual PA frequency; in particular, it was significantly improved in older adults who attended this type of PA more than once a week, with respect to those who had never performed it (never: MCS = 44.7 \pm 9.0; more than once a week: MCS = 52.8 \pm 10.2). Also, in this case, PCS was affected by neither the attendance at individual PA nor at the group one. Lastly, the higher attendance at group PA slightly improved the MCS of the participants, but the results were not significant (Figure 1(b)).

Furthermore, to analyze the correlation between age, attendance at individual and at group PA and other variables, Spearman's correlation coefficients have been evaluated (Table 2). As expected, the results showed a negative correlation between PCS and age ($p = 0.002$); considering the MCS, both the attendance at individual and group PA showed a significant positive correlation with this parameter ($p = 0.006$ and $p = 0.043$, respectively).

Correlations between variables were also evaluated using multiple linear regression analysis. To take into account the role of age in the PCS and MCS scores, delta values from reference PCS and MCS scores for age were considered as dependent variables. The PCS was confirmed not to be related to the attendance at any type of PA proposed (individual or group one) (Table 3); lastly, the deviation of residents' MCS from the reference value was positively related to the attendance at individual PA (standardized coefficient: 0.241; $p = 0.11$) and slightly related to the residents' group PA participation (standardized coefficient: 0.165; $p = 0.096$) (Table 3).

3.3. The 6-Week PA Intervention Results. Results from the inclusion of kinesiologist for 6 weeks in two RCFs showed an improvement in the residents' individual PA attendance (Figure 2(a)). Particularly, before the PA intervention, 18 out of the 36 residents involved in the prepost intervention assessment attested to perform individual PA, 50% of which affirmed to rarely take part to individual sessions, 33.3% once a week, and only the 16.7% more than once a week. Conversely, after the intervention, 35 out of the 36 involved subjects affirmed to perform individual PA, only 14.3% of which attested to attend at this type of PA rarely, 28.6% once a week, and 57.1% more than once a week. On the other hand, the number of RCFs residents who performed group PA was higher at the baseline, too, and remain almost constant over time: 34 and 32, pre and post the PA intervention, respectively. Assessing the frequency with which they attended the sessions before and after the program, results showed that the percentage of the older adults who rarely took part at group activities decreased from 11.8% to 6.3%; conversely, an increase in the participation to group activities once a week was observed (pre: 17.%; post: 31.3%); lastly, the residents' percentage who performed it more than once a week slightly decreases: 73.5% before and 62.5% after the PA program (Figure 2(a)).

Furthermore, assessing the effects of the intervention in modulating the residents' PCS and MCS, on average, they resulted improved (data not shown; PCS $p < 0.05$; MCS $p < 0.01$). To better interpret the results, data have been divided according to the number of sessions proposed by the kinesiologist in the RCF involved. As shown in Figure 2(b), the PCS was not modulated by the kinesiologist sessions offered once per week (mean value pre: 43.9 \pm 10.2; mean value post: 46.1 \pm 10.6; n.s.); conversely, the attendance at kinesiologist sessions once per week improved residents' MCS (mean value pre: 43.4 \pm 10.2; mean value post: 49.5 \pm 6.7; $p < 0.05$). Interestingly, the proposal of two sessions per week with the kinesiologist during the intervention period significantly improved both PCS and MCS in RCFs' older adults: the mean PCS value increased from 44.3 \pm 10.1 to 49.4 \pm 5.5 ($p < 0.05$), whereas the mean MCS value improved from 47.8 \pm 4.6 to 52.7 \pm 3.4 ($p < 0.01$) (Figure 2(b)).

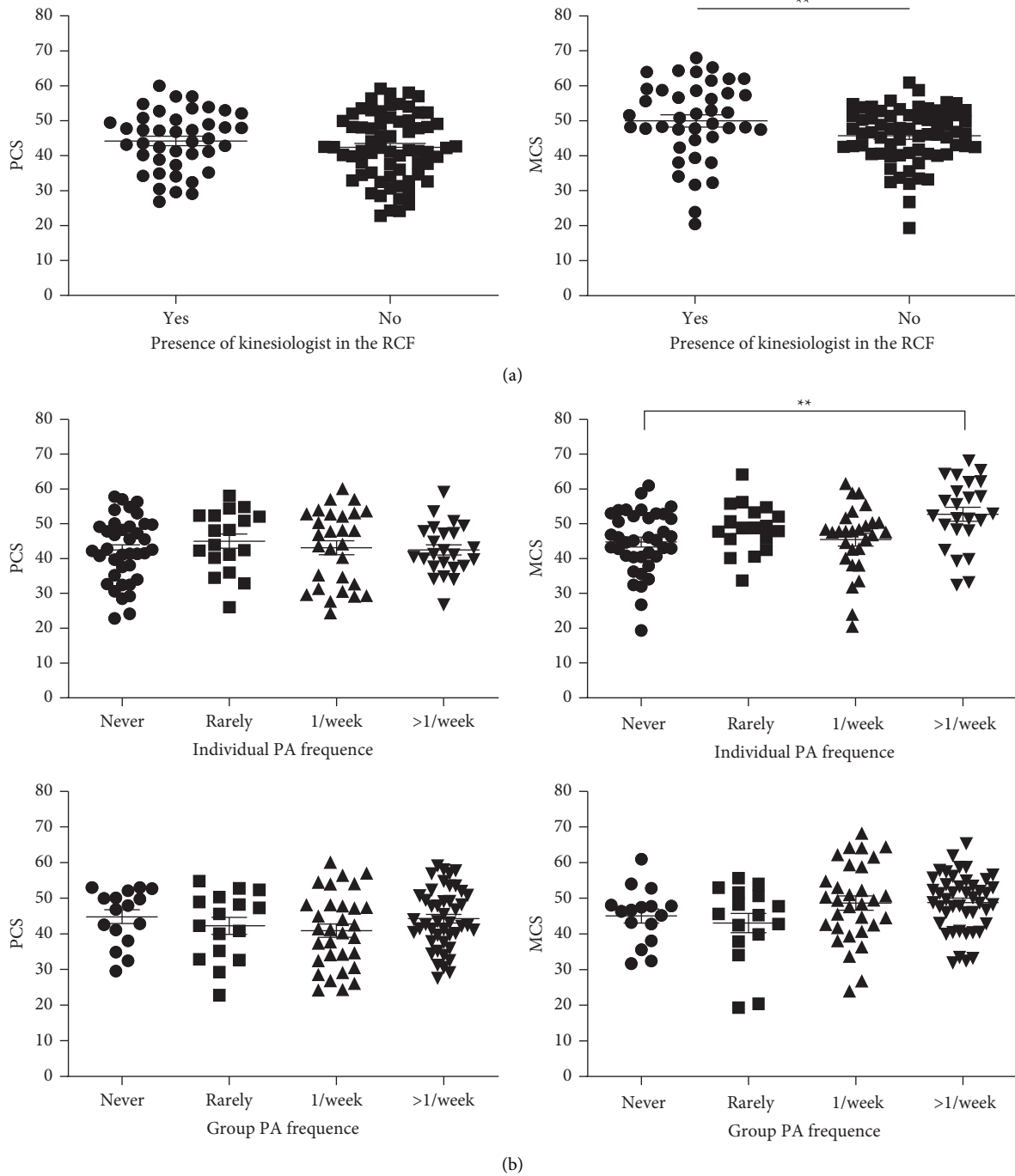


FIGURE 1: SF-12 questionnaire results and PA frequency at the baseline. (a) Physical component score (PCS) and mental component score (MCS) in residents living in RCFs with or without the kinesiologist. $**p < 0.01$; *t*-test. (b) PCS and MCS related to the attendance at individual and group PA. $**p < 0.01$; 1-way ANOVA followed by Dunnett’s multiple comparison test. PA: physical activity; PCS: physical component score; MCS: mental component score.

4. Discussion

The Italian epidemiological situation does not diverge from the European one, and the trend has worsened over time [19]. This acceleration in the pace of population ageing forces especially developing countries to a quick adaptation to the availability of infrastructures and care settings, to

support older adults who do not need to be in a hospital, but cannot be cared for at home [3]. In Italy, residential care facilities (RCFs) active in 2020 were 12,630, and this number was almost equivalent to that assessed ten years earlier [20]. Moreover, the relevant geographical differences remained unchanged from the previous year: 64% of all RCFs were in the regions of the North area. The total number of older

TABLE 2: Spearman’s correlation coefficients between PCS or MCS and RCF residents’ age, attendance at individual PA, and attendance at group PA.

		Age	Individual PA frequency	Group PA frequency
PCS	Correlation coefficient	-0.296**	-0.020	0.024
	<i>p</i> value	0.002	0.838	0.806
MCS	Correlation coefficient	0.011	0.260**	0.195*
	<i>p</i> value	0.910	0.006	0.043

**Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

TABLE 3: Multiple linear regression analysis results. Dependent variables were delta values from reference PCS (Delta PCSref) and MCS (Delta MCSref) scores for age.

Predictors	Delta PCSref		Delta MCSref	
	Standardized coefficients	<i>p</i> value	Standardized coefficients	<i>p</i> value
Age	-0.158	0.124	0.055	0.575
Individual PA frequency	0.028	0.772	0.241*	0.011
Group PA frequency	0.115	0.265	0.165	0.096

**p* < 0.05.

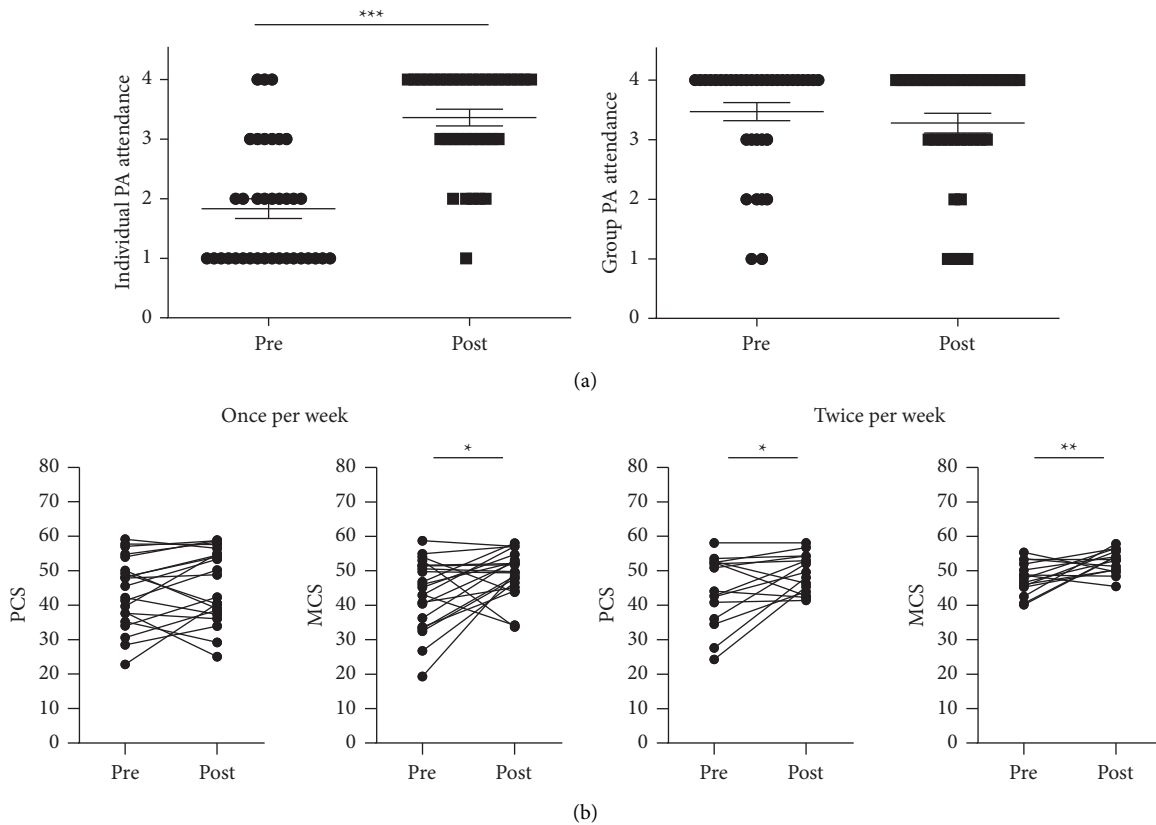


FIGURE 2: Results from 6-week PA intervention. Thirty-six residents belonging to two different RCFs participated to the PA program. (a) Changes in the attendance at individual or at group PA before and after the PA program. (b) Comparison of the SF-12 questionnaire results (PCS and MCS), based also on the number of PA sessions per week proposed by the kinesiologist during the intervention. * *p* < 0.05; ** *p* < 0.01; *** *p* < 0.001; paired *t*-test. PA: physical activity; PCS: physical component score; MCS: mental component score; Pre: before the intervention; Post: after the intervention.

adults living in the Italian RCFs in 2016 was around 289,000, 75% of which were over 65 and represented only about 2.1% of the relative population present in Italy [21]. These data suggest that the number of RCFs in Italy cannot be sufficient

for all the in need older people. The entrance to RCF is often necessary for an older adult to have medical assistance, nursing, and rehabilitation treatments, as well as the opportunities for community life.

For institutionalized individuals, maintaining autonomy and good physical, mental, and social health is crucial; a great interest in these objectives has been highlighted by the Decade of Healthy Ageing initiative, which aims to propose programs and assistive technologies to improve the functional abilities and well-being of older people living in RCFs [2]. A growing literature study also shows that in this setting, exercise and multidisciplinary programs can have beneficial effects on these outcomes, in particular on the mental health and cognitive functions of elders without dementia or cognitive impairments [7, 22]. However, a literature gap can be identified in data about the Italian RCFs because a small number of results are available in this type of institution. Starting from these concepts, the present work aimed to assess the initial mental and physical health status (MCS and PCS, respectively) of RCFs residents, to correlate these data with the attendance at individual and at group PA proposed in the structures. The baseline results showed mean values comparable to those identified by Ware et al. [17, 18] as the reference values (MCSref and PCSref), based on the age of the target population: MCSref: 45.6 and PCSref: 38.4. Interestingly, the MCS of the older adults living in RCFs in which a kinesiologist was present was statistically higher than in RCFs in which he was not included as a staff member, suggesting that his presence would lead to improved mental health in residents who are encouraged to participate more to PA sessions. These data were confirmed by the fact that the MCS resulted directly related to the weekly frequency of individual PA proposed, with its maximal value obtained with more than one session per week. Conversely, the PCS was affected neither by the presence of kinesiologist nor by the higher number of PA sessions per week. Data about the group PA was slightly unexpected; in fact, it did not change the health-related status of RCFs residents, even if in the case of high frequency, as, instead, previously reported by other authors [14, 15, 23–25]. Mental well-being is a well-known determinant of healthy ageing, and it has been demonstrated that physical exercise can have a role in cognitive functions [26]. In fact, studies have shown that the elderly who regularly engage in physical activities have a lower risk of dementia development and degenerative diseases through a decrease in low-grade chronic inflammation and neural plasticity improvement [27].

Lastly, to assess the effectiveness of sessions structured and monitored by a kinesiologist, a 6-week interventional program was proposed in two out of the included RCFs. Data obtained showed that the offer of PA sessions in RCFs, in which a kinesiologist was not present before, leads to an improvement in the attendance at individual PA and in residents' MCS. Moreover, results are in accordance with the previously reported ones [7], showing that the frequency of the performed physical activity sessions seems to be related to the efficacy of the intervention strategies: in the RCF in which the PA sessions were proposed twice a week, the health-related values improved more than in the facility in which the program was performed once a week. Interestingly, in the high weekly frequency intervention (2 sessions per week), also PCS statistically increased after only 6 weeks. These data introduced some information about the minimal time duration of the proposed program necessary to have improvements in health-

related values: in our previous review, literature data would suggest that a minimum of 8 weeks are necessary to have strong positive effects. In our study, combining a frequency of 2 sessions per week and an interventional program of six weeks was sufficient to have an improvement on both the mental and physical status of RCF residents. The positive effects of low-intensity PA sessions were confirmed, opening the opportunity to propose low-intensity aerobic and resistance exercises to RCFs' older adults, considering the inability of most of them to reach high intensities during their activities. Our study underlines, as reported by Da Silva et al. [22], how physical activity can affect the mental health of older adults living in RCFs and highlights the importance of incorporating exercise into the lifestyle as a treatment approach.

4.1. Limitations of the Study and Future Perspectives. The possible limitations of this study include the lack of PA intensity measurements and the use of only SF-12 questionnaire to assess the improvements in PCS values. The objective measurements of PA (i.e., accelerometers and pedometers) represent the best option in order to evaluate in detail intensity and frequency of PA as for as the physical fitness test that allows to investigate a potential effect of PA session not only on physical health status in general but more specifically on cardiorespiratory fitness. Using also other tests suitable for the measurement of the physical health status of the participants, more accurate results on this outcome could be obtained.

A potential future direction in this field of research could be the inclusion of this type of evaluation in a randomized or nonrandomized trial.

5. Conclusions

In conclusion, we have shown the potential of a 6-week PA interventional program in RCFs for older adults, in improving their perceived quality of life-related spheres, with a particular positive impact on their mental health. Moreover, we have highlighted the importance of the presence of a kinesiologist in RCFs to have a better commitment to older adults' PA attendance. Further investigations will include a larger number of RCFs and residents and the use of additional tests to better assess the modification on the physical health status of the participants.

Data Availability

The datasets generated and/or analyzed during the current study are not publicly available but are available from the principal investigator (PI) on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

The authors Baldelli Giulia and De Santi Mauro contributed equally to this work.

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