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Effectiveness of a training program for caregivers of institutionalized older people on sedentary behavior, physical activity, and functionality of residents

Efetividad de un programa de capacitación para cuidadores de ancianos institucionalizados sobre el comportamiento sedentario, atividad física y funcionalidad de los residentes

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Abstract. Training caregivers of institutionalized older adults about an expanded care approach seems to be a way to maintain the resident's capabilities from the long-term care perspective. Objective: to analyze the effectiveness of training for caregivers of institutionalized older adults on sedentary behavior (SB), physical activity (PA) levels, and functionality of residents. Methods: Instructional training (four weeks) followed by the caregiver goal application period (12 weeks). Primary outcomes: Sedentary behavior (accelerometry) and functional mobility (Timed Up and Go). Secondary: physical function (SPPB), the performance of activities of daily living (Barthel Index), physical activity (accelerometer), handgrip strength, and anthropometric measurements. All analyses were conducted according to the intention-to-treat principle. Generalized Estimating Equations (GEE) and the Bonferroni post-hoc test were applied for comparison between time points (pre and post-intervention) and groups ($p<0.05$). Results: 49 older adults participated in the study, 25 of which comprised the intervention group (IG) and 24 the control group (CG). There was a group and time interaction effect, and the IG showed a reduction in SB ($p=.017$), increased light PA ($p=.006$), and total PA ($p=.018$). There were no changes in moderate PA and functionality. Although not statistically significant, the Barthel Index increased by 6.8 points in the IG, a clinically meaningful difference. Conclusion: The caregiver training strategy can be important in reducing SB and promoting participation in PA, which is relevant, considering the profile of the institutionalized older adult population.
Keywords: Sedentary Behavior; Physical Functional Performance; Older Adults; Caregivers; Nursing home.

Resumen. Capacitar a los cuidadores de ancianos institucionalizados sobre un enfoque de atención ampliada parece ser una forma de mantener las capacidades del residente desde la perspectiva del cuidado a largo plazo. Objetivo: analizar la efectividad de la capacitación a cuidadores de ancianos institucionalizados sobre comportamiento sedentário (CS), niveles de actividad física (AF) y funcionalidad de los residentes. Métodos: Capacitación instructiva (quatro semanas) seguida del período de aplicación de objetivos por el cuidador (12 semanas). Medidas primarias: CS (acelerometría) y movilidad funcional (Timed up and Go). Secundarias: función física (SPPB), realización de actividades de la vida diaria (Índice de Barthel), AF (acelerómetro), fuerza de prensión manual y medidas antropométricas. Los análisis se realizaron según el principio de intención de tratar. Se aplicaron Ecuaciones de Estimación Generalizadas (GEE) y la prueba post-hoc de Bonferroni para la comparación entre puntos temporales (pre y postintervención) y grupos ($p<0,05$). Resultados: Participaron 49 ancianos, 25 formaron el grupo de intervención (GI) y 24 el grupo control (GC). Hubo un efecto de interacción de grupo y tiempo, y el GI mostró una reducción en el CS ($p=.017$), aumento de la AF ligera ($p=.006$) y AF total ($p=.018$). No hubo cambios en la AF moderada y la funcionalidad. Aunque no es estadísticamente significativo, el índice de Barthel aumentó 6.8 puntos en el GI, diferencia clínicamente significativa. Conclusión: La capacitación de cuidadores puede ser importante para reducir el CS y promover la participación en AF, lo cual es relevante, considerando el perfil de la población anciana institucionalizada.
Palabras clave: Comportamiento Sedentario; Rendimiento Físico Funcional; Ancianos; Cuidadores; Hogares para Ancianos.

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Introduction

Nursing homes (NHs) focus on health care and assistance for older people (Pollo & de Assis, 2008). In this modality, current policies encourage actions that allow older adults to remain active and functional according to their capabilities, which includes support and training for caregivers to provide the best possible care service (World Health Organization, 2023).

The concern about the institutionalized older population is plausible because this population presents a low active profile and spends considerable time in sedentary behavior (SB) (Kazoglu & Yuruk, 2020; Leung et al., 2021). While physical activity (PA) can be classified according to energy expenditure in light, moderate, and vigorous activity, SB is characterized by activities with low energy expenditure – less than 1.5 METS – typically performed in a seated position (World Health Organization, 2020). Despite measuring the same behavior, SB and PA are independent predictors of health-related variables and mortality (Mosquera & Vargas, 2021).

In addition, the structure of the nursing home (NH) service may not favor the participation of residents in daily activities, considering that aspects such as rules, norms, and fixed schedules for routines lead to the provision of care in a homogenized manner among older people, regardless of their autonomous condition (Furtado et al., 2021).

Including caregivers in actions that favor the reduction of SB seems relevant, since these professionals work through support in the daily lives of residents, situations in which opportunities for participation in activities occur (Sampaio, 2011). Studies indicate that interventions aimed at reducing SB and promoting PA among residents must correspond to the reality of each institution, considering the profiles of older people, organizational and environmental factors, and in a way that encompasses professionals (staff) that are present in everyday life (Wylie et al., 2023; Hawkins et al., 2018). There are studies involving caregivers of

institutionalized older adults to increase residents' PA levels (Galik et al., 2014; Jansen et al., 2018), involving different participation strategies for these professionals. However, to our knowledge, no proposals aim to change sedentary time behavior. This is a relevant point since SB is a predictor of adverse health-related outcomes (Petrusevski et al., 2021; Rezende et al., 2014) and functionality (Jiang et al., 2022; Rosenberg et al., 2016; Santos et al., 2012) for the aged population, which may contribute to the frailty of institutionalized older adults.

Therefore, this study aimed to analyze the effect of an intervention with caregivers of institutionalized older people on the residents' sedentary behavior, physical activity levels, and functionality. The present proposal consisted of instructional training, followed by a period of supervision for caregivers to set and implement goals with residents.

Methods

Study design

The present study is a randomized clinical trial. The total duration of the intervention was 16 weeks (four weeks of training and 12 weeks of goal application), from August 2022 to June 2023. A pre-intervention assessment and another immediately after the completion of the intervention were carried out. This study was submitted and approved by the Ethics and Research Committee of the Health Sciences Sector of the Federal University of Paraná, CAAE: 5 2187221.6.0000.0102, opinion number 5.140.516, on December 2, 2021. The study is registered in the Registry of Brazilian Clinical Trials (RBR-95M34PP).

Sample size

To establish the number of older adults participating in the study, the sample calculation was carried out using the G*Power 3.1 software. Based on the medium effect size of 0.30, confidence level = 95%, maximum sampling error = 5%, sampling power = 80%, number of groups = two, and number of measurements, a sample of 40 older adults was obtained. 20% was added for possible data losses, withdrawals, and refusals, totaling 48 participants distributed into two groups: intervention group (IG) n = 24; control group (CG) n =24.

The recruitment of older people took place at the institution itself. First, an NH manager contextualized residents and family members about the proposal, and subsequently, a researcher explained the research procedures in detail. After the consent of the older adult and their family member or legal representative, all participants signed the Informed Consent Form. The institutions were recruited through advertising via emails and messaging applications posted on their respective websites.

Eligibility And Randomization Criteria

Nursing Homes

The eligibility criteria for the NHs were institutions located in Curitiba – Paraná, Brazil, of a private or philanthropic legal nature. The exclusion criterion assigned was for institutions that exclusively served older adults who were bedridden or in a palliative care situation. The disclosure was made via email messages and telephone numbers available on NH websites, with six institutions returning the first contact and agreeing to participate in the study. The institutions were equivalent in terms of the number of residents, services, and care characteristics. Two institutions offered physical activities once a week, while the others offered them twice weekly. The assessments were carried out in the institutions themselves.

Considering the recruited institutions were similar, they were randomized to constitute the intervention (IG) and control (CG) groups. This allocation strategy was chosen because, if randomization was carried out based on participants, there could be a bias in the application by the trained caregiver if IG and CG residents lived in the same location. Other studies with NH caregivers adopted the same allocation procedure (Forster et al., 2021; Lamppu et al., 2021; Slaughter et al., 2014).

In the first data collection (August/2022), four institutions were recruited to participate in the research, of which two were assigned by the IG and the other two to the CG. A second data collection was carried out in February/2023 with the other two institutions, in which one was drawn for the GI and the other allocated to the CG. In this way, older adults from three institutions made up the IG, and three institutions made up the CG. The training was offered to all working caregivers at GI institutions.

Participants

The study included men and women aged 60 years or over who were residing in NHs. The exclusion criteria were older people with compromised physical capacity resulting from recent traumas or muscular diseases, such as falls, fractures, ongoing rehabilitation, and wheelchair users. No cutoff points were applied for cognitive status or physical performance tests to obtain participants who represented the range of the functional profile of institutionalized older adults. As a criterion for participation in the study, the participant must have completed at least one of the primary outcome measures (accelerometry or Timed Up and Go).

Measurements

Participants characteristics

Sociodemographic data were collected. To assess cognitive status, the Mini-Mental State Examination (MMSE) was used (Anthony et al., 1982). In the present study, the participant's total score was considered. Additionally, to classify the cognitive status according to the subject's education, the following scores were considered, which are valid for the Brazilian population: illiterate – 13 points; one to four incomplete years – 18 points; four to eight incomplete years – 18 points; eight years or more – 26 points (Bertolucci et al., 1994).

Primary outcomes

The variables sedentary behavior and functional mobility were considered as the primary outcome of this study. Sedentary behavior was assessed using an accelerometer (Actigraphy, model GT3X) attached to a belt around the hip and sampling at 30Hz. Data were collected continuously for seven consecutive days, except for sleeping and bathing. Thus, older people and the caregiver team were instructed on how to use the device by verbal and printed instructions and received periodic supervision from a researcher.

The analysis of accelerometer data was performed considering at least four valid days, with a minimum daily usage time of eight hours (i.e., containing >480 minutes of usage time) (Airlie et al., 2022). The number of counts/min used to define SB was ≤99 counts/min (Matthews et al., 2015). Due to differences in the use time between pre-and post-intervention times, it was decided to use the SB percentage as a reference to compare the different assessments.

Functional mobility was assessed using the Timed Up and Go (TUG) test (Podsiadlo & Richardson, 1991).

Secondary outcomes

Functionality consisted of the following variables: physical function, performance of activities of daily living, and handgrip strength. Physical function was assessed using the Short Physical Performance Battery (SPPB), (Guralnik et al., 1994). The Barthel Index (BI) was used to observe activities of daily living (ADLs) (Minosso et al., 2010). A team member answered the questionnaire. Handgrip strength was assessed using the Saehan® handgrip dynamometer, with a scale ranging from zero to 100 kilograms of force (kgf). Anthropometric measurements determine body mass index (weight and height) and abdominal circumference.

Physical activity (PA) was assessed using the accelerometer, following the same criteria presented in the description of the primary outcomes. The number of counts has also been used to identify light PA (LPA, ranging from 100 to 1040 counts/min) and moderate PA (MPA; ≥1041 counts/min) (Copeland & Esliger, 2009; Sasaki et al., 2017). Similar to the analysis of the SB variable, for comparison purposes between the pre-and post-intervention periods, the percentage of PA intensities was decided to be used as a reference.

Data collect

Data collection took place in the spaces of the institutions compatible with each assessment. Initially, participants responded to the sociodemographic questionnaire and the MMSE. Then, anthropometric measurements were collected, and functional tests were in the following order: TUG, SPPB: four-meter walking speed (4MWS), balance test, and five-time sit-to-stand test (5STS). Participants were given verbal instructions, and a demonstration was also provided. The tests were performed on the same day, with a five-minute rest interval between tests and attempts. Two opportunities were offered to perform functional tests, and the best performance was used for subsequent analysis. The use of mobility aids, such as canes and walkers, was permitted during mobility tests. When participants could not perform the test (due to the need for physical assistance, not understanding the instructions, or refusals/humor), they were kept in the study, and the result of the respective test was not included.

Intervention

The intervention consisted of two phases: first, instructional training with caregivers and, subsequently, a period of formulating and applying goals, which a researcher supervised.

Over four weeks, instructional training was carried out in weekly sessions, lasting between 30 minutes and one hour. The topics covered were presented in the following sequence: 1) Aging: physical, cognitive, functional, and social aspects; 2) Sedentary Behavior and Physical Activity: concepts and benefits of reducing sedentary behavior and increasing physical activity; 3) Physical and social environment in the NH: barriers and facilitators to reduce sedentary behavior and increase physical activity; 4) Strategies for action. The topics covered were adapted from Giné-Garriga et al. (2019). Short videos on the subject were made available before the meetings, as well as a manual with a description and practical examples of all the topics covered in the training.

The goal application phase occurred for 12 weeks, during which a researcher was at the institution weekly to help develop, review, and grade the goals related to reducing sedentary behavior, increasing light physical activity, and participating in daily life. The goals were formulated individually and in groups, according to the capacity of each resident, covering situations such as short walks in the institution's spaces, increased participation in activities of daily living, interruption of prolonged sitting, and progressive increase in the number of steps. The number of steps was monitored using a smartwatch, the Xiaomi Mi Band 5®. The progression regarding the reduction of SB, including light-intensity physical activities (activities of daily living, short walks), was based on the recommendations of the World Health Organization (2020), highlighting that the levels of effort in daily PA needed to be proportional to the older adult's aptitude.

Fifteen caregivers were recruited from GI institutions and began training. Fourteen participants completed the training in full. In the goal application phase, twelve caregivers remained until the sixth week and eight professionals remained until the application was completed. Professionals who replaced absent caregivers during the goal application phase received brief training and were encouraged to assist in goal development and implementation.

Statistical analyses

Descriptive statistics were performed to characterize the participants, presented as the mean and standard deviation for continuous variables and frequency distribution for

categorical variables. The data normality distribution was verified using the Kolmogorov-Smirnov test. The t-test was applied to identify possible differences between GI and CG for sample characterization data, with an equivalent test for variables that did not present normal distribution (Mann-Whitney). To compare GI and CG regarding categorical variables, the chi-square, and Fisher's F tests were used, also according to the distribution of the variables.

The intention-to-treat (ITT) protocol was applied to the present study; all initially randomized participants were included in the final data analysis (McCoy, 2017). The interpolation data imputation method was used for participants who did not complete the post-intervention assessment (Nich & Carroll, 2002).

To evaluate the effects of the intervention, the three effect models of the Generalized Estimating Equations (EEG) test were used: group, time, and interaction between both. The AR(1) covariance matrix and the Bonferroni post-hoc were considered (Guimarães & Hirakata, 2012). The variables compared were continuous and assumed a linear or gamma probability distribution with an identity link function (Ballinger, 2004). The adherence criterion defined the best model structure based on the lowest value obtained in QIC - quasi-likelihood under the independence model criterion (Cui, 2007).

Statistical analyses were performed using IBM SPSS Statistics software (version 20; SPSS Inc., Chicago, IL) with a significance level of $p<0.05$.

Results

Initially, all residents living in NHs were recruited (n= 85). However, 36 did not meet the inclusion criteria. The IG comprised 25 participants (NH A= 7; NH B= 10; NH C= 8), while the CG comprised 24 participants (NH D= 5; NH E= 8; NH F= 11). Sixteen participants from the IG and 15 from the CG participated in the post-intervention evaluation. Residents who were allocated to the IG and presented as "did not receive the intervention" (n=4) left the study during the period in which caregivers received instructional training (one to four weeks). Details regarding sample allocation and analysis are described in Figure 1.

There were no differences between the IG and CG participants concerning age and the distribution between the categories of the variables gender and education. However, the IG had a lower MMSE score, a higher number of diseases, and increased medication use. Despite the statistical differences, both groups have a low MMSE score, and only two participants from the IG reached the cutoff point based on education. This indicates that cognitive decline may characterize institutionalized older people and be related to the reason for institutionalization. The groups showed no difference in the other health-related variables. Table 1 describes the data that characterize the sample.

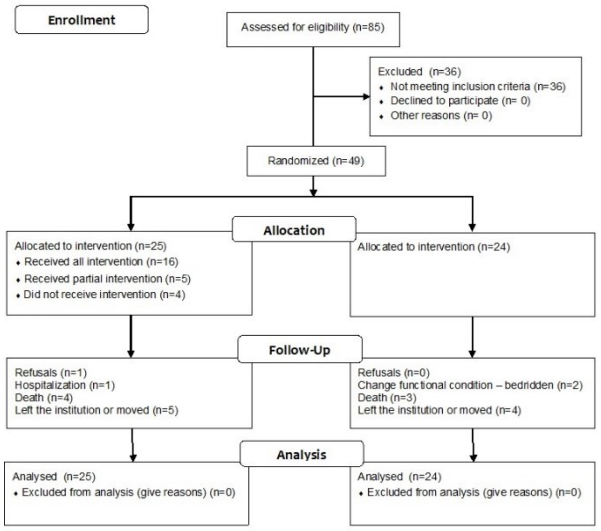

Figure 1. Experimental design and study flowchart

Table 1.
Sample characterization

Variables	IG (N=25)	CG (N=24)	Total (N=49)
Sociodemographic Characteristics			
Age (Years – M, DP)	81.6 ± 9.0	81.8 ± 8.6	81.7 ± 8.8
Gender (N, %)			
Female	18 (72%)	15 (62,4%)	33 (67,3%)
Male	7 (28%)	9 (37,6)	16 (32,7%)
Education (N, %)			
Illiterate	1 (4%)	3 (12,5%)	4 (8,2%)
1-4 Years	13 (52%)	10 (41,7%)	23 (46,9%)
5-8 Years	5 (20%)	7 (29,1%)	12 (24,5%)
9-11 Years	3 (12%)	0	3 (6,1%)
11+ Years	3 (12%)	4 (16,7%)	7 (14,3%)
Mental Status			
Mmse (Score – M, DP)	11.3 ± 5.6	17.3 ± 6.6*	14.3 ± 6.8
Mmse (Classification)			
Above The Cut-Off Point	0	2 (8,4%)	2 (4,1%)
Below The Cut-Off Point	25 (100%)	22 (91,6%)	47 (95,9%)
Health-Related Variables			
Diseases (M, DP)	2.5 ±1.0*	1.7 ± 1.3	2.2 ± 1.3
Medicines (M, DP)	7.2 ± 3.0*	4.8 ± 1.9	6.0 ± 3.0
Surgeries - Last Year (N, %)	2 (8%)	1 (4,2%)	3 (6,1%)
Hospitalization – Last Year (N, %)	6 (24%)	4 (16,7%)	10 (20,4%)
Mobility (N, %)			
Independent	14 (56%)	10 (41,7%)	24 (49%)
Walking Stick	0	5 (20,8%)	5 (10,2%)
Walker	7 (28%)	8 (33,3%)	15 (30,6%)
Guided By Another	4 (16%)	1 (4,2%)	5 (10,2%)
Physical Activity Promoted in NH			
Participated (N, %)	19 (76%)	16 (66,6%)	35 (71,4%)
Did not participate (N, %)	6 (24%)	8 (33,4%)	14 (28,6)

*p<0,05
IG: Intervention group; CG: Control group; MMSE: Mini-mental State Exam

Table 2 presents the number of residents who used the accelerometer and completed the functional tests in the first assessment, showing no statistical difference in the distribution of participants between the groups (p.>0.05). In total, 34 participants completed the tests and received the accelerometer, of which 16 were from the IG and 18 from the CG. Residents chose not to use the accelerometer mainly due to discomfort with the attached device, concerns about

potential damage, or device failure. Regarding the functional tests, participants did not complete them because they did not understand the instructions, needed a lot of help during the test (physical or verbal, or that influenced performance), were unable to perform it safely, or because they refused to use it.

Table 2.
Description of participants who used an accelerometer and completed the functional tests

Instruments	IG (N=25)	CG (N=24)	Total (N=49)	P valor
Accelerometer				
Used	22 (88%)	19 (79%)	41 (83%)	.087
Did not use	3 (12%)	5 (20%)	8 (17%)	
Functional Tests				
TUG	17 (68%)	21 (87,5%)	38 (77%)	.101
SPPB	19 (76%)	23 (95%)	42 (85%)	.094
Accelerômeter + Tests	16 (64%)	18 (75%)	34 (69%)	.094

IG: Intervention group; CG: Control group; TUG: Timed up and go; SPPB: Short Physical Performance Battery.

Table 3 presents data related to anthropometric variables, functionality, and level of physical activity before and after the intervention. For anthropometric variables, there was no statistically significant difference between groups ($p>0.05$).

No differences were observed between groups regarding functional tests (TUG, SPPB, and handgrip strength). According to the Barthel Index, IG showed greater dependence than the CG in the baseline ($X^2(2) = 8.446$, $\beta = 11.71$ [3.81 – 19.61 CI]; $p = 0.004$). This variable also showed a difference after intervention ($X^2(2) = 4.46$, $\beta = -6.79$ [-13.2 – -0.30 CI]; $p = 0.040$), observing an increase of 6.8 points in the GI, while in GC it was 2.2. Although there was no group-time interaction, a change of 6.8 points verified in the GI is considered a clinically meaningful difference.

The percentage of time spent in SB was similar between groups before and after intervention. However, there was verified a significant group-time interaction. The group that received intervention reduced the sedentary time by 3.5%, while CG increased by 1.53% ($X^2(2) = 5.684$, $\beta = -5.03$ [-9.17 – -0.89 CI]; $p = 0.017$). Differences were observed between group-time interaction for the percentage of light physical activity ($X^2(2) = 7.522$, $\beta = 3.99$ [1.13 – 6.84 CI]; $p = 0.006$), in which GI increased 2.46% LPA, while CG reduced 1.52% between assessments. Regarding moderate physical activity, there were no differences between group, time, or significant values between the interaction between group and time ($p>0.05$). When light and moderate physical activity were grouped, no differences were found between group and time. However, there was an group-time interaction ($X^2(2) = 7.619$, $\beta = -3.472$ [-5.938 – -1.007 CI]; $p = 0.018$). A 1.53% reduction in total PA was noted in the CG, while GI increased by 3.47%.

Table 3.
Comparison between groups in pre- and post-intervention assessments (mean and ± standard error)

Variables	IG			CG			Statistical		
	Pre	Post	Dif	Pre	Post	Dif	Time	Group	Time*Group
Anthropometrics									
BMI (kg.m^{-2})	22.5 ± 0.67 (21.23 – 23.89)	23.7 ± 0.50 (22.71 – 24.69)	1.13	24.8 ± 1.01 (22.84 – 26.81)	24.3 ± 0.88 (22.63 – 26.08)	-0.47	$X^2(2) = 0.501$ $p = .479$	$X^2(2) = 2.043$ $p = .153$	$X^2(2) = 2.983$ $p = .84$
Abd Circumf. (cm)	92.7 ± 2.32 (88.11 – 97.24)	91.9 ± 1.73 (88.53 – 95.33)	-0.74	93.4 ± 2.50 (88.48 – 98.29)	91.6 ± 1.64 (88.37 – 94.82)	-1.79	$X^2(2) = 0.958$ $p = .328$	$X^2(2) = 0.005$ $p = .943$	$X^2(2) = 0.163$ $p = .686$
Functionality									
TUG (seconds)	30.6 ± 4.20 (22.32 – 38.81)	33.6 ± 3.62 (26.53 – 40.73)	3.06	41.0 ± 7.30 (26.71 – 55.37)	35.5 ± 3.44 (28.72 – 42.23)	-5.56	$X^2(2) = 0.115$ $p = .735$	$X^2(2) = 1.100$ $p = .294$	$X^2(2) = 1.371$ $p = .242$
SPPB (score)	4.5 ± 0.53 (3.47 – 5.56)	5.0 ± 0.49 (4.13 – 6.06)	0.5	4.8 ± 0.51 (3.81 – 5.82)	4.7 ± 0.40 (3.91 – 5.49)	-0.1	$X^2(2) = 0.339$ $p = .561$	$X^2(2) = 0.007$ $p = .933$	$X^2(2) = 0.802$ $p = .370$
BARTHEL INDEX	65.2 ± 4.21 (56.93 – 73.46)	72.0 ± 3.28 (65.56 – 78.42)	6.80	81.4± 3.46 (74.66 – 88.25)	83.7± 2.34 (79.12 – 88.29)	2.25	$X^2(2) = 4.547$ $p = .033$	$X^2(2) = 10.556$ $p = .001$	$X^2(2) = 1.147$ $p = .284$
Handgrip Strength (kgf)	14.2 ± 1.26 (11.73 – 16.69)	13.1 ± 0.97 (11.17 – 14.98)	-1.13	16.3 ± 1.53 (13.29 – 19.30)	14.1 ± 1.12 (11.88 – 16.30)	-2.20	$X^2(2) = 2.764$ $p = .096$	$X^2(2) = 1.157$ $p = .282$	$X^2(2) = 0.285$ $p = .593$
Physical Activity									
SB (%)	84.9 ± 1.50 (82.01 – 87.92)	81.4 ± 1.45 (78.61 – 84.32)	-3.50	78.4 ± 2.06 (74.35 – 82.46)	79.9 ± 1.57 (76.85 – 83.02)	1.53	$X^2(2) = 0.870$ $p = .351$	$X^2(2) = 3.663$ $p = .056$	$X^2(2) = 5.684$ $p = .017$
LPA (%)	10.4 ± 0.93 (8.54 – 12.21)	12.8 ± 0.90 (11.07 – 14.62)	2.46	15.4 ± 1.64 (12.20 – 18.64)	13.9 ± 1.21 (11.51 – 16.28)	-1.52	$X^2(2) = 0.419$ $p = .518$	$X^2(2) = 3.487$ $p = .050$	$X^2(2) = 7.522$ $p = .006$
MPA (%)	4.64 ± 0.80 (3.06 – 6.22)	5.68 ± 0.62 (4.46 – 6.90)	1.03	6.16 ± 0.93 (4.33 – 7.99)	6.15 ± 0.62 (4.92 – 7.38)	-0.01	$X^2(2) = 0.723$ $p = .395$	$X^2(2) = 1.261$ $p = .261$	$X^2(2) = 0.750$ $p = .386$
TOTAL PA (%)	15.02 ± 1.50 (12.07 – 17.98)	18.50 ± 1.45 (15.64 – 21.35)	3.47	21.59 ± 2.06 (17.53 – 25.64)	20.05 ± 1.57 (16.97 – 23.13)	-1.53	$X^2(2) = 0.842$ $p = .359$	$X^2(2) = 3.692$ $p = .055$	$X^2(2) = 5.617$ $p = .018$

IG: Intervention group; CG: Control group; BMI: Body mass index; Kg: Kilogram; M: Meter; Abd Circumf.: Abdominal circumference; Cm: Centimeter; TUG: Timed up and go; SPPB: Short physical performance Battery; Kgf: Kilogram force; SB: Sedentary behavior; LPA: Light physical activity; MPA: Moderate physical activity.

Discussion

The present study aimed to identify the effects of an intervention with formal caregivers of institutionalized older adults on the residents' sedentary behavior, physical activity levels, and functionality. To our knowledge, this is the first study that promoted training and involved caregivers in the development and application of strategies to reduce residents' time spent in sedentary behavior. Additionally, the study analyzed possible changes over time in physical activity, functional mobility, and functionality in the elderly. The main findings of this study were a reduction in SB, an

increase in LPA and total PA, and a significant improvement in ADL performance in the group that received the intervention. It is important to emphasize that the group-time interaction observed in this study resulted from the improvement in the intervention group and the worsening in the control group throughout the 12 weeks of intervention.

Despite the recognized benefits of reducing SB and increasing LPA, the present study identified no effects on performance in functional tests, such as functional mobility and physical function. This result corroborates other studies, suggesting that light PA is possibly insufficient to improve physical function and functional capacity (Edholm et al., 2019). In this sense, it can be expected that an increase in time in moderate or vigorous PA is necessary to promote improvement in functionality in the older population (Izquierdo et al., 2021).

Although studies based on isotemporal analyses indicate that replacing sedentary time with time spent in PA at different intensities can benefit the functionality of frail (Martins et al., 2023) and institutionalized older people (Del Pozo-Cruz et al., 2022) it was not verified in the present study. Indeed, it is difficult to achieve high levels of PA in people with low physical activity and poor functional capacity. Furthermore, the organization and rules of NHs do not usually favor a more active lifestyle (Grönstedt et al., 2013; Kalinowski et al., 2012). Even so, the present proposal follows the recommendations for reducing SB for the institutionalized older population. Sedentary time should be gradually replaced by light PA initially, to then incorporate physical activities and higher-intensity exercises (De Souto Barreto et al., 2016). Although the changes in SB and LPA were small, the results presented indicate a possible behavior change, which is relevant considering the profile of this population.

Concerning the Barthel Index, both groups increased their scores after the intervention, but the IG showed an increment twice as large as the minimum clinically significant change, which was not verified in the CG (Bouwstra et al., 2019). This fact highlights the effectiveness of the strategies to increase participation and independence in ADLs proposed to the IG during the intervention.

We emphasize that all phases of the intervention were applied considering the breadth of the profile of institutionalized residents concerning functional aspects (physical and cognitive). It is noteworthy that the approach, including instructional training and also assistance and supervision in the application of goals aligned with the reality of each location, was possibly the difference in this intervention proposal. The frequency of weekly supervision may also have been a relevant factor in enabling the review and goal adjustments. A study conducted with formal caregivers of older people with dementia in-home care (Rooijackers et al., 2021), with an average frequency of meetings every two months, did not identify effects in reducing SB. No conclusive results on interventions mediated by caregivers were identified among the institutionalized population. Although this intervention model using caregivers seems viable, adjustments were needed to optimize the intervention for a representative population (Forster et al., 2021).

In a study carried out with 31 older people from four different NHs, a proposal by staff members aimed at guiding family members and residents to meet the goals, presented preliminary results with a medium effect size of reducing sedentary time. The intervention lasted 12 weeks, with an average frequency of meetings every two weeks (Giné-Garriga et al., 2020). From this perspective, in line with the results of the present study, approaches with more frequent contact with those implementing the intervention may be more effective in reducing the SB of institutionalized older people. Furthermore, it is reinforced that interventions must be compatible with the context of each institution and with the capabilities of each older person.

The present study has some limitations. The turnover of professionals may have influenced the effect, in addition to not allowing the permanence of the effects of the intervention to be identified through a subsequent evaluation (follow-up). Although short training was offered to new professionals, as well as being encouraged to participate equally in the stage of implementing the goals, factors related to adaptation to a new job may have influenced this process. Additionally, the study was carried out after the most critical period of the COVID-19 pandemic. This fact can influence the engagement of professionals with training. In two of the six institutions, the start of the study was postponed due to active cases among professionals and residents. The sample size limited the construction of more complex statistical models that could expand the explanation of the phenomena, considering that the population is heterogeneous.

The strengths of the intervention are highlighted, such as its easy applicability in the clinical context. It is encouraged that professionals who work in NHs, such as physical education professionals, physiotherapists, and occupational therapists, take on the role of guiding the team of caregivers about tangible goals and activities that the residents can engage in, enhancing the effects of their conventional intervention. It is suggested that future studies include these health professionals, as well as training a professional to coordinate the team of caregivers and help with the supervision and systematization of these goals.

Another aspect is the encouragement of caregivers to also participate together with the residents in the physical activities proposed in the institution, as well as the role of encouraging residents to engage in these activities more consistently. This perspective to increasing time spent in PA intensities can bring improvements in functionality components. It is also worth highlighting the possibility of the intervention being inclusive and being able to be applied to the broad profile of residents, as it considers individual capacity to develop goals.

Conclusion

The caregiver training strategy was important to reduce sedentary behavior and promote participation in physical

activities, which is relevant, considering the profile of the institutionalized older population. It is noteworthy that, although the improvements concerning the reduction of sedentary behavior and the increase in physical activity have been small if lasting, they can contribute to improving the health of this population. In this way, the proposal presents options for reapplication in the daily routine of institutions. Future studies involving managers and other health professionals from these institutions should be conducted, as they can enhance the results observed in the present study.

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