The effects of Art therapy on executive functions and attention in Parkinson's disease: Systematic Review and Meta-Analysis

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ABSTRACT

Objectives: Art therapies are emerging non-pharmacological complementary treatments for Parkinson's disease (PD). This systematic review and meta-analysis aimed to evaluate their effects on non-motor symptoms, motor symptoms, quality of life (QoL), and activities of daily living (ADLs) in adults aged 50 years and older with PD.

Methods: PubMed, Scopus, Cochrane, and Web of Science databases were searched from 2014 to 2025. Of 40 initially identified studies, 33 met inclusion criteria and were included in the review; 24 were incorporated in the meta-analysis using a robust variance estimator to address repeated measurements.

Results: Art therapy was associated with significant improvements in both executive functions [RVE (Mean) = 0.971, 95% CI (0.951, 0.991), Z = 50.323, p < 0.001] and attention [RVE (Mean) = 0.854, 95% CI (0.834, 0.874), Z = 10.892, p < 0.001]compared with controls in the follow-up [RVE Mean)= 0.971 95%CI(0.951, 0.991), Z=50.323, p<0.001]. In single-group studies, depressive symptoms decreased post-intervention [RVE (Mean) = 6.289, 95% CI (1.101, 11.477), Z = 10.878, *p* = 0.049] but increased again at follow-up [RVE (Mean) = 12.094, 95% CI (0.318, 23.871), Z = 10.878, *p* = 0.049] Conversely, outcomes such as freezing of gait, QoL, and PD progression at follow-up favored the control groups rather than the treatment groups

Conclusions: Evidence suggests that Art therapy may enhance executive functioning — especially at follow-up— and attention in older adults with PD. However, current evidence does not demonstrate consistent benefits in other non-motor or motor outcomes and ADLs. Brief, structured interventions (e.g., 20 sessions of 60 minutes, twice weekly) administered by dance instructors appear most promising. The improvements observed in control groups further underscore the potential value of active, structured interventions such as exercise or rehabilitation.

Clinical Implications: Art therapy may serve as a valuable non-pharmacological intervention to support executive functioning and attention in older adults with PD, with improvements observed at follow-up. Single-group studies suggest potential short-term benefits for depressive symptoms, although these effects may not be sustained over time. Structured interventions in high-quality controlled trials, personalized to patient profiles and preferably delivered by specialized professionals, may optimize outcomes. Further research based on high-quality, adequately powered clinical trials is needed to identify the most effective approaches and to determine whether benefits extend beyond cognitive outcomes. Direct comparisons of different art-based modalities may help identify the most effective approaches for improving patient outcomes.

Keywords: Art Therapy; Music Therapy; Dance Therapy; Parkinson´s Disease; Executive functions; Depression; Freezing of gait; Progression of Parkinson´s Disease.

1. Introduction

Parkinson's disease (PD), the second most common neurodegenerative disorder, affects approximately 6.2 million people worldwide (Fothergill-Misbah et al., 2022). It is characterized by the progressive degeneration of dopaminergic neurons in the substantia nigra (Chen et al., 2023), leading to hallmark neuropathological features such as Lewy bodies and neuronal loss. Currently, definitive diagnosis is only possible post-mortem (Martínez-Fernández et al., 2016).

The global incidence, prevalence, and disability burden of PD are steadily rising, with age-standardized annual increases of around 0.5-0.6% (Ou et al., 2021). The number of affected older adults is projected to double by 2040 (Titova & Chaudhuri, 2018); age is the main risk factor (Beheshti, 2025), and men are more likely than women to develop the disease, although women may experience faster progression and higher mortality (Cerri et al., 2019). Environmental exposures such as pesticides and industrial chemicals have also been associated with increased risk in human studies (Zafar, S., & Yaddanapudi, 2023).

PD presents a wide range of motor (e.g., bradykinesia, freezing of gait, balance issues) and non-motor symptoms, including cognitive impairment, depression, anxiety, and apathy, all of which significantly affect QoL and functional independence (Pfeiffer, 2016; Tsuboi et al., 2022).

Executive dysfunction is particularly relevant, given its association with ADLs and progression to dementia (Bode et al., 2024; Weintraub et al., 2018). ADLs performance in PD is related to multiple cognitive domains, with attention, executive function, and memory being particularly relevant. Cognitive ADLs impairment is characterized by behavioral anomalies such as trial-and-error behavior or task step omissions, and is associated with lower engagement in everyday activities (Bode et al., 2024). In addition, recent evidence indicates that lower attention scores are predictive of worse global cognition and increased risk of progression to mild cognitive impairment (MCI) or dementia in PD (Gasca-salas et al., 2023). In this context, Chung et al. 2020 (Chung et al., 2020) investigated which baseline neuropsychological profiles predict dementia risk in early-stage PD by performing a factor analysis that identified four cognitive domains: visual/visuospatial memory, verbal memory, frontal/executive, and attention/language. Composite scores were then derived for each individual, reflecting performance across these domains. Better performance in the frontal/executive domain was associated with approximately a 57.5% lower risk of developing dementia (HR = 0.425; 95% CI [0.305–0.593]), demonstrating that executive dysfunction is the strongest cognitive predictor of progression to PD dementia.The growing burden of PD poses major challenges to healthcare systems and families, especially due to the chronic nature of the disease and need for long-term support (Escamilla Sevilla, F., González Torres, V., & Moya Molina, 2022). While no cure

exists, treatment aims to preserve autonomy and QoL through a combination of pharmacological and non-pharmacological strategies (Garcia de Yebenes et al., 2023; Pardo-Moreno et al., 2023).

Among complementary non-pharmacological approaches, Art therapy have gained increasing recognition for their positive effects on psychological, motor, and cognitive outcomes in PD (Ettinger et al., 2023; Li et al., 2024). Art therapy is a mental health profession that improves the lives of individuals, families, and communities through engaged art-making, the creative process, the application of psychological principles, and human experience within a psychotherapeutic relationship (American Art Therapy, 2025), and it is based on the idea that creative artistic processes facilitate repair and healing, and it constitutes a form of psychotherapy in which image creation and object usage are the primary forms of expression and communication (Çınar, 2022). In addition, Art therapy focuses on supporting the client's personal growth through the use of art materials in a safe and facilitating environment. It is not a recreational activity or an art class, although the sessions can be enjoyable (Galassi et al., 2022). These interventions—such as music, dance, painting, and drama therapy—promote self-expression, emotional processing, and neuroplasticity, and may provide holistic benefits across motor and non-motor domains (Shafir et al., 2020; Upadhyay & Pal, 2024).

Several systematic reviews and meta-analyses have evaluated the impact of art-based interventions—especially dance and music—on specific PD symptoms. However, no comprehensive meta-analysis has yet compared the full spectrum of Art therapy (including visual art therapy, singing therapy, theatre and drama therapy) in relation to motor and non-motor symptoms, executive functions, attention and QoL.

This systematic review and meta-analysis aims to evaluate the effectiveness of various forms of Art therapy on cognitive, neuropsychiatric, motor symptoms, QoL, and ADLs in older adults with PD, both as standalone treatments and in combination with pharmacological approaches.

2. Methods

This systematic review adheres to the PRISMA-S (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Rethlefsen et al., 2021) (see **Supplementary file 1, Table 1**) and was registered in the PROSPERO database (ID number: CRD 42024560669).

2.1. Search strategy

Three electronic databases; i.e., PubMed, Web of Science, Scopus and Cochrane Library were used in this study. The specific search parameters used in all online databases are shown in **Supplementary file 2, Table 2**. The search terms were adjusted to each respective database. The search was conducted from 2014/01/01 to 2025/02/24. When possible, the search included a vocabulary thesaurus (list of MeSH terms in PubMed). First, the related terms of "Parkinson

disease" were combined as follow: "Parkinson Disease" OR "Parkinsonian Disorders" OR "Parkinson´s Disease" OR "Parkinsonian Diseases". Secondly, the related terms of "Art therapy" were combined as follow "Art therapy" OR "Therapy, Art" OR "Art Therapies" OR "Therapies, Art" OR "Art-therapy" OR "Arts therapy" OR "Dance therapy" OR "Music therapy" OR "Visual arts" OR "Theatre" OR "Drama therapy" OR "Therapeutic singing". Finally, both terms were combined with "AND".

2.2. Eligibility criteria

A specific question was constructed according to the PICOS (Participants, Interventions, Control, Outcomes, and Study Design) principle (**Table 1**).

Table 1. PICOS criteria for inclusion and exclusion of studies (Santos et al., 2007).

Parameter	
Participants	Adults with PD whose average age is 50 years or older.
Interventions	Art therapy (dance, music, visual arts, theatre, drama and singing) as a non-pharmacological intervention in PD.
Control/comparator group	Passive (no intervention) or active controls (different intervention than intervention group) or usual care.
Outcomes	Evaluate: 1) non-motor cognitive symptoms such as global cognition, attention, executive functions, cognitive flexibility and progression of PD; 2) non-motor neuropsychiatric symptoms such as apathy, anxiety, fatigue, and depression; 3) motor symptoms such as balance, functional mobility, risk of falls, endurance, freezing of gait, motor aspects; 4) QoL and 5) ADLs.
Study design	Randomized controlled trials, clinical trials, observational, and pre-post studies.

The following inclusion criteria were applied: (1) original studies (randomized controlled trials (RCTs), clinical trials, observational studies, and pre-post studies); (2) studies conducted in humans; (3) studies written in English or Spanish; (4) participants with an average age is 50 years or older and (5) diagnosis of PD according to the International Parkinson and Movement Disorder Society (MDS), Clinical Diagnostic Criteria for PD (MDS-PD Criteria), clinical diagnosis of PD or clinical diagnosis of possible or probable PD and the UK PD Society Brain Bank, Gelbs criteria and diagnosis by experts.

The following exclusion criteria were applied: (1) articles that did not provide original data (e.g., systematic reviews, meta-analyses, literature reviews); (2) participants diagnosed with other cognitive impairments different from PD; (3) studies that include other types of cognitive intervention different from Art therapy; (4) studies involving any type of Art therapy together with another non-pharmacological intervention and do not provide results separately.

2.3. Study selection and data extraction

Two authors (IG-S, JEAB) independently searched each database to obtain publications. Agreement between the authors was found for 90% of the publications, while the remaining discrepancies were resolved through discussion. Relevant articles were obtained in full and

assessed against the inclusion and exclusion criteria and data were managed using an Excel spreadsheet. Disagreements between the reviewers were resolved by consensus; when consensus could not be reached, arbitration by a third reviewer was applied (EC).

2.4. Quality assessment

National Heart, Lung, and Blood Institute website (NIH National Heart, Lung, 2013) was used for the assessment of the quality of the studies included in the present systematic review and meta-analysis.

2.5. Publication bias

The revised Cochrane risk of bias tool for randomized trials (RoB 2) (Higgins & Thompson, 2002), or non-randomized studies (ROBINS-I) (Sterne et al., 2011) and observational studies (New Castle Ottawa) (Wells, G., Shea, B., & O'Connell, 2015) were used to assess the risk of bias in the studies included in the present systematic review and meta-analysis. For each study, two co-authors (IGS-JEAB) independently assessed the risk of bias.

2.6. Statistical analyses to conduct the meta-analyses

All the studies included in the present meta-analysis and systematic review met the established inclusion criteria. However, during data extraction, some information was missing. Although corresponding authors (Bega et al., 2017; Butala et al., 2022; Calabria et al., 2024; Cucca et al., 2021; Duncan & Earhart, 2014; Feenstra et al., 2022; Mondolfi, M. L., Savage, M., & Fernández-Aguayo, 2021; Prewitt et al., 2017; Schlesinger et al., 2014; Shanahan et al., 2017) were contacted by e-mail to collect the missing information to conduct the meta-analyses, we received a response from only one of them (Calabria et al., 2024).

The following subgroups were analyzed: 1) age ("50-69 year/ ">70 years"); 2) type of Art-therapy ("dance therapy" or "music therapy" or "singing therapy" or "visual art therapy"); 5) duration total duration of intervention ("short-term" (duration of the art-therapy is less than 3 months); "maintenance or medium-term" (duration of the art-therapy is between 3 and 6 months); or "long-term" (duration of the art-therapy is more than 12 months) (Aguirre et al., 2010); 6) study quality of studies ("Good quality"; or "Fair quality") (NIH National Heart, Lung, 2013); 7) "origin of the studies ("America", "Asia", or "Europe") and 8) type of control (passive, active or usual care) based on the condition that subgroup analysis could be conducted with a minimum number of studies.

2.7. Statistical analysis

For the statistical analysis we used the program R Ver. 4.1.3 (R Foundation for Statistical Computing, Institute for Statistics and Mathematics, Welthandelsplatz 1, 1020 Vienna, Austria)

and the packages metafor (Viechtbauer, 2010) and meta (Balduzzi, S., Rücker, G., & Schwarzer, 2019).

When studies reported the median and interquartile range instead of the mean and standard deviation, or confidence intervals instead of standard deviations, these were calculated using the appropriate formulas (Higgins JPT, 2011; Luo D, Wan X, Liu J, 2018; Shi J, Luo D, Weng H, Zeng XT, Lin L, Chu H, 2020). Likewise, in studies that reported results stratified by variables other than those assessed were reported, data from these subgroups were combined using the appropriate formulas (Higgins JPT, 2011).

Due to the analysis of two measurement moments in the studies (post-treatment and follow-up), the procedure described by Efthimiou et al. (Efthimiou et al., 2017) was followed by performing a sensitivity analysis on the meta-analysis with an autoregressive lag 1 (AR1) model adjusting the correlation between the different measurement moments (pre-post-treatment and follow-up) with a correlation of 0, 0. 2, 0.5 and 0.8, the selection criterion was based on the model with the most accurate results in its confidence intervals and, if there were no differences, the most parsimonious model without autocorrelation.

A multilevel meta-analysis was performed to evaluate the effect of intervention versus control at post-treatment and follow-up, using the standardized mean difference (SMD) or mean difference (MD) according to the use of the same scale in clinical trials, and with the mean in single-group studies. A random-effects model was applied due to heterogeneity between studies. Due to the violation of the independence principle when analyzing repeated measures in the studies (post-treatment and follow-up), standard errors were adjusted using the robust variance estimator (RVE) proposed by Pustejovsky and Tipton (2018) (Tipton E, 2015) and applying the Satterthwaite adjustment to the degrees of freedom. The effect size thus calculated was defined as small (<0.2), moderate (0.2-0.8), and large (>0.8). Heterogeneity was analyzed by estimating the between-study variance (τ^2) calculated with the Restricted Maximum Likelihood (REML) estimator, Cochran's Q test and the I^2 estimator, the latter defining heterogeneity as unimportant (<30%), moderate (30%-50%), large (50%-75%) and important (>75%).

Subgroup analyses were also performed to explore the heterogeneity detected in both motor and cognitive variables on post-treatment and follow-up effects. Finally, publication bias was analyzed by visual analysis of funnel plots and Egger's test.

2.8. Sensitivity analysis

The level of autocorrelation in the variables with post-treatment and follow-up results did not affect either the level of significance or the precision, therefore, he most parsimonious models without autocorrelation are selected, except for motor aspects variables, where the model with an autocorrelation of 0.8, quality of life with an autocorrelation of 0.5, and cognitive flexibility with an autocorrelation of 0.2 are selected (see **Supplementary file 3 and 4, Figure 1 and Figure 2**).

3. Results

3.1. Study Selection

The initial search provided a total of 609 records. The process used to detect duplicates was carried out through Microsoft Excel and the process was repeated twice, with a final manual revision. After removing duplicates and including studies identified through reference scanning, 158 potentially relevant studies were found, which were further filtered based on their title and abstract, remaining 40. After reading the full texts, 32 articles were finally included in the systematic review and 23 articles the meta-analysis. The PRISMA diagram for the study selection is detailed in **Figure 1** and studies excluded after full-text review (see **Supplementary file 5, Table 3**). If data were still unavailable, then the article was not included in the meta-analysis but was included in the narrative synthesis.

Ten studies evaluated non-motor cognitive symptoms, which included: 6 studies for global cognition, 3 for attention, 4 for executive functions, 3 for cognitive flexibility and 3 in relation to progress of PD; 14 studies evaluated non-motor neuropsychiatric symptoms among which they are distributed as follows 4 apathy, 3 anxiety, 14 depression, and 3 fatigue; 14 studies evaluated motor symptoms of which 4 study balance, 2 freezing of gait, 3 endurance, 10 risk of falls, 6 motor aspects, and 8 functional mobility; 14 for QoL and in addition 3 for ADLs (**Figure 2**).

3.2. Study characteristics

The main characteristics of the participants and art-therapy were extracted from the selected studies and can be consulted in **Table 2.**

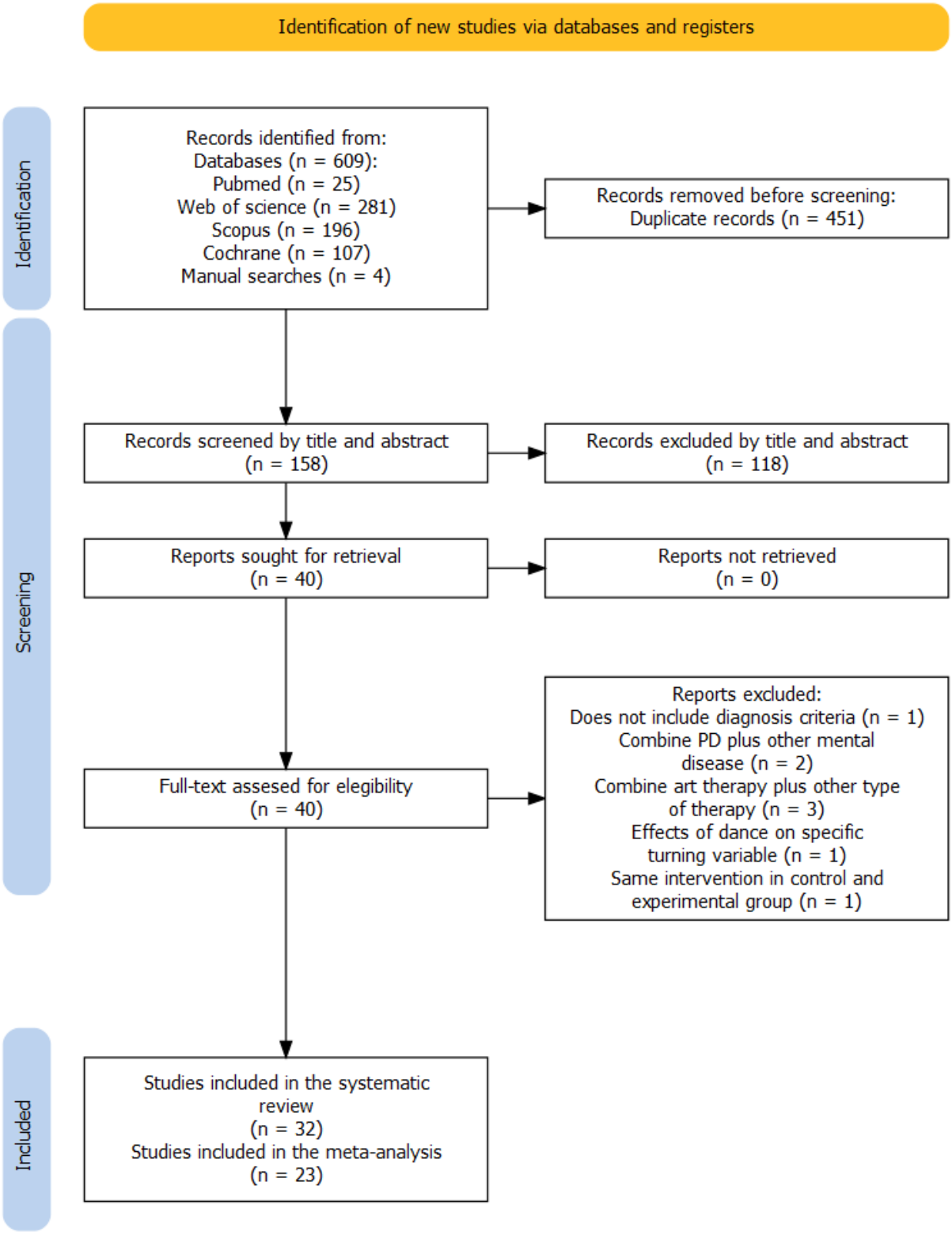


Figure 1. PRISMA Diagram- the process of study selection. From: Rethlefsen, M. L., Kirtley, S., Waffenschmidt, S., Ayala, A. P., Moher, D., Page, M. J., & Koffel, J. B. (2021). PRISMA-S: an extension to the PRISMA Statement for Reporting Literature Searches in Systematic Reviews. *Systematic Reviews*, 10(1), 1-19. https://doi.org/10.1186/S13643-020-01542-Z.

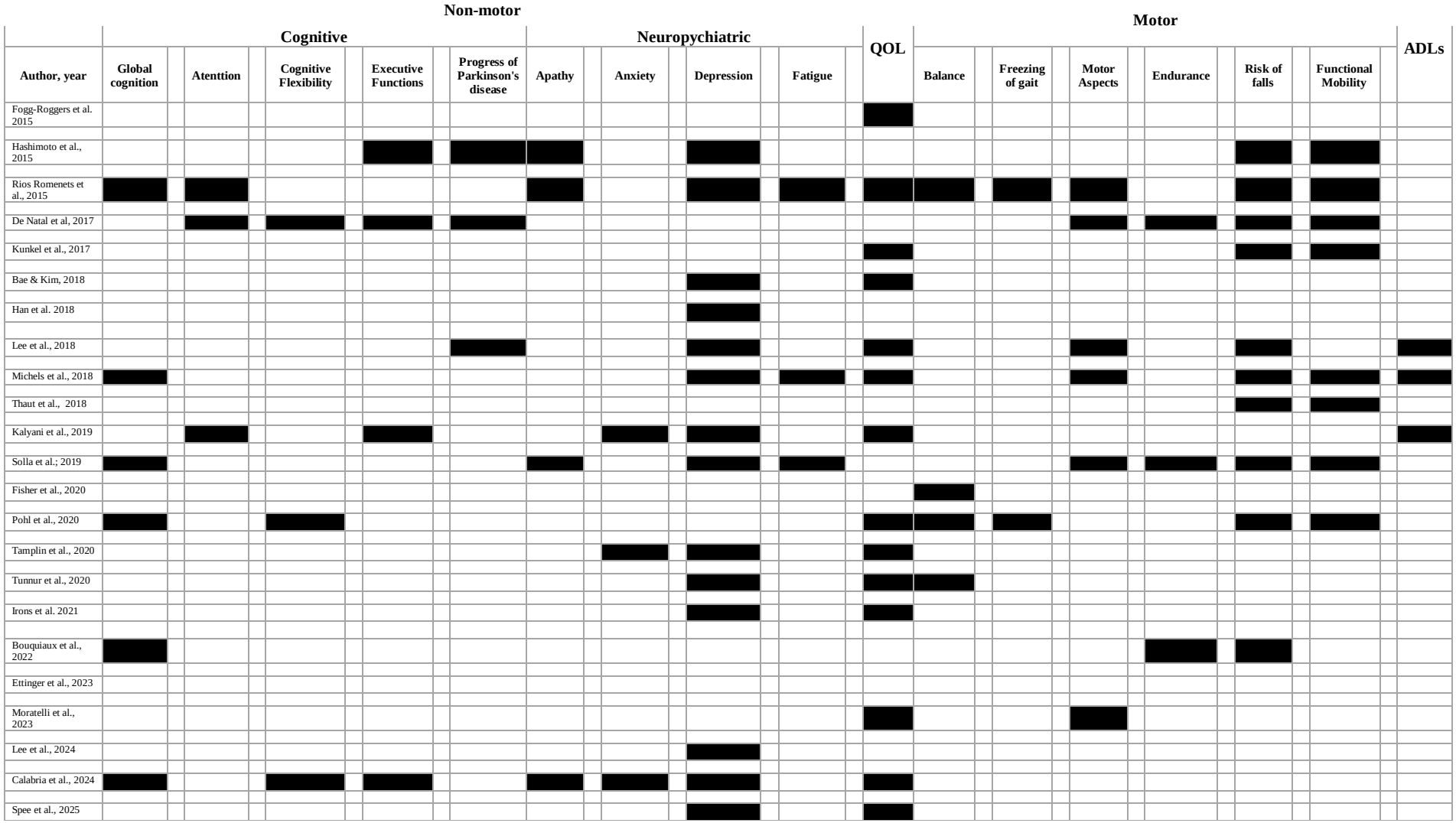


Figure 2. Non-motor, QoL, Motor and ADLs variables included in the meta-analysis.

Table 2. Main characteristics of the participants.

Author, year (Type of Study)	Anti-parkinsonian medication	Frequency (duration, session/week)	Professionals that administered the intervention	Control Group	Diagnosis criteria (Stage of PD)	N (male/female)	Country (setting)	Mean age (Standard desviation)	Mean Disease duration	Main Results
Dance Therapy										
1-Duncan & Earhart, 2014 (Duncan & Earhart, 2014) RCT	Levodopa	60 min/session Twice a week 24 months	2 Dance instructors	Passive	PD idiopathic Hoehn & Yahr Stages I-IV	10 (5/5) IG:5 CG:5	USA (Washington University School of Medicine's Movement Disorders Center)	67.8 ±8.8	8.8±5.7	Mini-BESTest: d.s (p<0.001); MDS-UPDRS I-II I: d.s. (p<0.001) and 6MWT: d.s. (p<0.0001)
2-Hashimoto et al., 2015 (Hashimoto et al., 2015) Pre-post study (quasi-randomized trial)	PD Medication	60 min/session One a week 12 weeks 12 sessions	Dance instructors	**Active:** Physical exercise **Passive**	PD idiopathic Hoehn & Yahr Stages II-IV	46 (12/34) IG:15 CGa: 17 CGp:14	Japan (Community)	66.76± 8,63	7±4.9	TUG: d.s. (p=0.005); BBS: d.s. (p=0.001); FAB: d.s. (p=0.001); MRT response time: d.s. (p<0.001); AS: d.s. (p<0.001); SDS: d.s. (p = 0.006); and UPDRS: d.s. (p<0.001)
3-Rios Romenets et al., 2015 (Rios Romenets et al., 2015) Clinical trial	Levodopa	60 min/session Twice a week 12 weeks 24 sessions	Dance instructors	**Active:** Exercises for people with PD	PD idiopathic Hoehn & Yahr Stages, I-III	33 (19/14) IG:18 CG:15	Canada (Movement disorders clinics of the McGill University Health Centre and the Parkinson Society Quebec)	63.75±9	6.6±4.5	TUG: d.s. (p=0.012); and Mini-BESTest: d.s. (p<0.001)
4-De Natale et al, 2017 (De Natale et al., 2017) Clinical trial	Levodopa	60 min/session Twice a week 10 weeks 20 sessions	Dance instructor	**Active:** Traditional rehabilitation	PD diagnosis of Gelb's criteria (Gelb et al., 1999) Hoehn & Yahr Stages n.s.	16 (11/16) IG: 9 CG:7	Italy (Community)	68± 6.15	6.16±2.16	TUG: d.s. (p=0.007); 6MWT: d.s. (p=0.028); TMT-A: d.s. (p=0.014); and TMT-B: d.s. (p=0.036)
5-Kunkel et al., 2017 (Kunkel et al., 2017) RCT	Levodopa	60 min/session Twice a week 10 weeks 20 sessions	2 Dance instructors	Usual care	PD Hoehn & Yahr stage I-III	46 (25/26) IG: 31 CG: 15	UK (Community)	70.5±6.85	5.85±4.2	The benefits participants reported were social in nature. Participants who identified clear benefit from the dancing in terms of balance or mobility were in the minority.
6-Prewitt et al., 2017 (Prewitt et al., 2017) Pre pos study	n.s.	60min/session Twice a week 8 weeks 16 sessions	2 Physiotherapists	-	Diagnosed with PD by a physician Hoehn & Yahr stage I-III	6 (3/3)	USA (Community)	74.5	n.s	ADLs: d.s. (p=0.001)
7-Shanahan et al., 2017 (Shanahan et al., 2017) RCT	Usual medication treatment	90 min/session One a week 10 weeks 10 sessions	Dance instructors	Usual care	PD idiopathic Hoehn & Yahr stage 1-2.5	41 (26/15) IG:20 CG:21	Ireland (Community)	69±9	5.75±7	Mini-BESTest: n.s.d. (p=0.07); PDQ-39: n.d.s (p=0.07); and UPDRS: n.s.d. (p=0.07)
8-Lee et al., 2018 (Lee, H. J., Kim, S. Y., Chae, Y., Kim, M. Y., Yin, C., Jung, W. S., ... & Lee, 2018) RCT	n.s.	60 min/session Twice a week 8 weeks 16 sessions	Dance instructor	Passive	PD Diagnosed by experts Hoehn & Yahr Stages I-III	41 (17/24) IG: 16 CG:25	Korea (Community)	65.75 ± 6.8	4.45±3.2	UPDRS: d.s. (p= 0.001); and PDQ: d.s. (p= 0.049)
9-Michels et al., 2018 (Michels et al., 2018) RCT	PD Medication	60 min/session Once a week 10 weeks 10 sessions	Dance instructors	Passive	PD idiopathic Diagnosed by experts using the Movement Disorder Society Hoehn & Yahr Stage IV	13 (6//7) IG: 9 CG: 4	USA (Community)	70.97	n.s	The study was underpowered to assess whether the differences were statistically significant.
10-Kalyani et al., 2019 (Kalyani et al., 2019) Clinical trial	Levodopa	60 min/session Twice a week 12 weeks 24 sessions	Dance instructors	Passive	PD idiopathic Clinical diagnosis "Definitie PD" Hoehn & Yahr Stages I-III:	33 (13/20) IG: 17 CG:16	Australia (Community)	65.87±9,79	4.85±3.24	NIH-episodic memory: d.s. (p= 0.04); TMT-B: d.s. (p= 0.02); HADS: d.s. (p= 0.00); UPDRS-II (ADLs): d.s, (p= 0.01); and PDQ 39: d.s. (p = 0.01)
11-Solla et al., 2019 (Solla et al., 2019) RCT	Levodopa	90 min/session Twice a week 12 weeks 24 sessions	Dance instructors	Usual Care	PD Clinical diagnosis according to Gelb's criteria (Gelb et al., 1999) Hoehn & Yahr Stages I-III	20 (13/7) IG: 10 CG: 10	Italy (Community)	67.45±6.1	4.7±3,7	6MWT: d.s. (p < 0.001); BBS: d.s. (p < 0.001); FTSST: d.s. (p < 0.001); TUG: d.s. (p < 0.001); BST: d.s. (p= 0.04); and MOCA: d.s. (p= 0.012)
12-Fisher et al., 2020 (Fisher et al., 2020) Pre-post quasi-experimental study	n.s.	90 min/session Once a week 10 weeks 10 sessions	Dance instructors	-	PD Diagnosed by experts Hoehn & Yahr Stages 1.5-4	10 (4/6)	Canada (Community)	65,8	n.s	BESTest: d.s. (p<0.0001); and SCOPA-cog: d.s. (p= 0.0299)

Author, year (Type of Study)	Anti-parkinsonian medication	Frequency (duration, session/week)	Professionals that administered the intervention	Control Group	Diagnosis criteria (Stage of PD)	N (male/female)	Country (setting)	Mean age (Standard desviation)	Mean Disease duration	Main Results
Dance Therapy										
13-Tunur et al., 2020 (Tunur et al., 2020) Pre-post pilot study	n.s	20 min/session Everyday 3 weeks	Team of researchers	-	PD Diagnosed by experts using the MDS Hoehn & Yahr Stages >3 and MDS-UPDRS Part III >57	7 (3/4)	USA (Community)	69 ± 5.5	6.9 ± 6.9	TUG: n.s.d. (p= 0.17); MiniBESTest: n.s.d (p= 0.1556); and PDQ-39: n.s.d. (p= 0.1750)
14-Bouquiaux et al., 2022 (Bouquiaux et al., 2022) Clinical trial	n.s.	60 min/session Once a week 16 sessions 16.weeks	Dance instructor	Passive	PD Diagnosed by experts	14 (8/6) IG: 8 CG:6	Belgium (Community)	66.5	6.75	10-meter (seconds): d.s. (p= 0.009); and VAS Happiness: d.s. (p= 0.015)
15-Feenstra et al., 2022 (Feenstra et al., 2022) Observational study (Pre-Post Design)	n.s.	60 min/session Once a week 22 weeks 22 sessions	Dance instructors	-	PD MDS-UPDRS	37 (21/16)	Netherlands (Community)	68± 7,9	n.s	PDQ-39: d.s. (p < 0.001); and UPDRS-III: d.s. (p < 0.001)
16-Moratelli et al., 2023 (Moratelli et al., 2023) Clinical trial	n.s.	60 min/session Twice a week 24 sessions 12 weeks	n.s	**Active**: Dance (forró, samba) + play activities for social and cognitive-motor stimulation **Passive**	PD Clinical diagnosis According to UK brain bank criteria (Hughes et al. 1992)	69 (34/35) FSG:23 SG=23 CG=23	Brazil (Community)	69.7±9,1	n.s	UPDRS-III: d.s. (p= 0.000)
Music Therapy										
1-Schlesinger et al., 2014 Observational study (Prospective case cohort pilot)	Levodopa for≥4 weeks before intervention	30 min/session 12 weeks	Psychotherapist	-	PD Idiopathic UK PD Society Brain Bank Criteria Hoehn & Yahr Stages II-IV	21 (11/10)	Israel (Movement Disorder Clinic at the Rambam Health Care Campus)	61.4±12.3	10.3 ± 5.13	UPDRS: d.s. (p=0.001)
2-Thaut et al., 2018 (Thaut et al., 2018) RCT	PD Medication	30 min/session 24 weeks	Music Therapy	**Active:** Dicontinued Rhythmic auditory stimulation	PD idiopathic Hoehn & Yahr Stages III-IV	47 IG:25 CG: 22	USA (Community)	72±7.5	11.05±5.5	Rhythmic auditory stimulation training significantly reduced the number of falls in PD.
3-Pohl et al., 2020 (Pohl et al., 2020) RCT	Levodopa	60 min/session Twice a week 16 sessions 8 weeks	Physiotherapists	Usual Care	PD Diagnosed by experts Hoehn & Yahr Stages I-III	46 (32/14 IG: 26 CG: 20	Sweden (Community)	70.05±6.5	6.4±4	PDQ-39: d.s. (p <0.05); and FESI: d.s. (p <0.05)
Singing Therapy										
1-Fogg-Roggers et al. 2015 (Fogg-Rogers et al., 2015) Pre-post qualitative study	PD Medication	The Choral Singing Therapy had been launched two years previously; choir members varied in prior attendance from six months to two years.	Music Therapist	-	PD idiopathic Hoehn & Yahr Stages ns	6 (4/2)	New Zealand (Community)	64.16	6	Choral singing therapy participation was perceived as improving mood, language, breathing, and voice
2-Han et al., 2018 (Han et al., 2018) Pre-post quasi-experimental study	Levodopa	50 min/session Three times a week 2 weeks 6 sessions	Music Therapist	-	PD UK Parkinson's Disease Society Brain Bank Clinical Diagnostic Criteria	9 (3/6)	Korea (Movement disorder center)	65.7±7.7	4.8±3	MPT: d.s.(p < 0.05); VHI: d.s. (p < 0.05); GDS: d.s. (p < 0.05); and V-RQOL: d.s. (p < 0.05)
3-Irons et al., 2021 (Irons et al., 2021) Observational study (Mixed-Methods, Pre-Post Design)	n.s	60 min/session Once a week 22 weeks 6 months	Singing Facilitators	-	PD Diagnosed by experts Initial Stages	95 (52/43)	UK,Australia And South Korean (Community)	69.7	6.71	PDQ-39 (Stigma and Social): d.s. (p= 0.001); and DASS (Stress and anxiety): d.s. (p= 0.001)
Author, year (Type of Study)	**Type of Art Therapy (Anti-parkinsonian medication)**	**Frequency (duration, session/week)**	**Professionals that administered the intervention**	**Control Group**	**Diagnosis criteria (Stage of PD)**	**N (male/female)**	**Country (setting)**	**Mean age (Standard desviation)**	**Mean Disease duration**	**Main Results**

4-Tamplin et al., 2020 (Tamplin et al., 2020) Clinical trial	47% Levodopa	120 min/session 12 months (weekly versus montly)	Music Therapist and speech therapist	**Active 1 (weekly) and active 2 (montly):** dance, painting, or tai chi classes adapted for PD with the aim of the socialization component	PD MDS-UPDRS	75 (46/29) SW: 20 SM: 27 CW: 15 CM 13	Australia (Community)	74.3± 8.1	8.9±6.1	VAPP: d.s. (p= 0.001); DASS-A: d.s. (p <0.037); and DASS-D: n.s.d. (p <0.093)
Singing Therapy										
5-Butala et al., 2022 (Butala et al., 2022) RCT	PD Medication	90 min/session Once a week 24 weeks 24 sessions	Professional coral	**Active:** Sessions Semi-structured reading	PD Clinical diagnosis according to UK Brain Bank criteria (Hughes et al. 1992)	26 (16/10) IG:13 CG: 13	USA (Community)	68.6 ±8.5	n.s	PDQ-39 (Emotional Well-being and Body Discomfort): d.s. (p= 0.001)
6-Lee et al., 2024 (Lee et al., 2024) RCT	PD Medication	30 min/session 1 session	Music Therapist	**Active:** Straw Phonation (spealing and singing) **Active**: Speaking	PD idiopathic Hoehn & Yahr Stages I-III	27 (13/14) TGS:10 SP+TGS :10 CG: 7	USA (Community).	73.30±6.03	10.54±6.30	Mood: Anxiety, anger and sadness: d.s. (p= 0.001)
Theatre										
1-Bega et al., 2017 (Bega et al., 2017) Clinical trial	Levodopa	60 min/session One a week 12 weeks 12 sessions	Instructors	-	PD UK brain bank criteria Hoehn & Yahr Stages II-IV	22 (14/8)	USA (Northwestern PD and Movement Disorders Center)	68.5	n.s	UPDRS II (ADLs): d.s. (p=0.019)
2-Calabria et al., 2024 (Calabria et al., 2024) Clinical trial	n.s	120 min/session 3 months	Professional coach	**Active**: CS	PD International criteria (Lees et al., 2009) by a neurologist specializing in movement disorders	34 (22/12) IG:17 CS: 17	Spain (Community)	63.9±8.6	9.4±6	PDQ-39 (Emotional well-being): d.s. (p= 0.03)
Drama Therapy										
1-Mondolfi et al., 2021(Mondolfi, M. L., Savage, M., & Fernández-Aguayo, 2021) Pre-post study	xx	90 min/session every two weeks 5 session 10 weeks	Two drama Therapists	-	MDS-UPDRS n.s	7 (1/6)	Spain (community)	68.3	n.s	There is improvement in depressive symptomatology but it is not significantly relevant
Visual Art Therapy										
1-Bae & Kim, 2018 (Bae & Kim, 2018) Observational study	57.5% Levodopa	80 min/session Twice a week 8 weeks 16 sessions	Art Therapist and Psychologist	**Active:** **Routine** rehabilitation programs (physical activities, games, oral-motor exercise and logical/ arithmetic puzzle solving)	PD Hoehn & Yahr Stage, I-III	54 (22/32) IG:26 CG: 28	South Korea (Long-term care centers)	81.17±7.44	8.73±4.93	BBT: d.s. (p<0.001); ABAS: d.s. (p<0.001); PDQOL: d.s. (p<0.001); GDSSF-k: d.s. (p<0.001)
2-Cucca et al., 2021 (Cucca et al., 2021) Clinical trial	Levodopa	60 min/session Twice a week 12 weeks	Art Therapists	Passive	PD idiopathic MDS-UPDRS Hoehn & Yahr Stages I-III	32 (16/16) IG: 18 CG:14	USA (Community)	67.25±8.85	6.2±4.6	RCFT: d.s. (p= 0.0383); and UPDRS: d.s. (p= 0.0368)
3-Ettinger et al., 2023 (Ettinger et al., 2023) Pre-post study	xx	90 min/session Twice a week 20 sessions 10 weeks	Art Therapists	-	PD Clinical diagnosis MDS	32 (16/16)	USA (Community)	67.25±8.85	6.2±4.6	HTP-PDS: d.s. (p < 0.001)
4-Spee et al., 2025 Pre-post study (Spee, B., Stap, T. B., Plijnaer, M., Pasman, G., Zeggio, S., Duits, A., ... & Koksma, 2025)	Levodopa	90–120 min/sessions One a week 10 weeks 10 sessions	4 Arts Therapists	-	PD MDS-UPDRS	8 (3/5)	Netherlands (Community)	54.50±9.01	6.75±2.98	HADS-Anxiety: d.s. (p= 0.008); and PDQ-39: d.s. (p= 0.021)

ABAS: Assertive Behavior Assessment Scale; ABC: Activities-Specific Balance Confidence Scale; ADLs: Activities of Daily Life; AS: Apathy Scale; BDI: Beck Depression Inventory; BBS: Berg Balance Scale; BBT: The Box and Block Test; BST: Back Scratch Test; CG: Control Group; CGa: Active Control Group; CGp: Passive Control Group; CM: Control Monthly; CW: Control Weekly; CS: Cognitive Stimulation; DASS: Depression, Anxiety, Stress Scale; d.s: Significant Differences; FAB: Frontal Assessment Battery; FESI: Falls Efficacy Scale International; FOG-Q: Freezing of Gait Questionnaire; FSS: Fatigue Severity Scale; FTSST: Five Times Sit-to-Stand; GDS: Geriatric Depression Scale; GDSSF-K: Geriatric Depression Scale Short Form-Korean Version; HTP-PDS: The House-Tree-Person PD Scale; IG: Intervention Group; MDS-UPDRS: Movement Disorder Society-Unified Parkinson Disease Rating Scale; Mini-BESTest: Mini-Balance Evaluation Systems Test; MoCA: Montreal Cognitive Assessment; MPT: Maximum Phonation; MRT: Mental Rotation Task; n.s: not specified; n.s.d: no significant difference; PD: Parkinson's Disease; PDQ-39: Parkinson's Disease Questionnaire-39 Items; PDQOL: Parkinson's Disease Quality of Life; PFS-16: Disease Fatigue Scale; RCFT: Rey-Osterrieth Complex Figure Test; RCT: Randomized Controlled Trial; SAS: Beck Depression Inventory; SCOPA-cog: Scales for Outcomes in Parkinson's disease-Cognition; s.d.: significant differences: SDS: Self-Rating Depression Scale; SM: Singing Monthly; SP + TGS: Straw Phonation Combined with Therapeutic Group Singing; SW: Singing Weekly; TAVEC: Test de Aprendizaje Verbal España-Complutense;

TGS: Therapeutic Group Singing; TMT: Trail Making Test; TUG: Timed Up and Go; UK: United Kingdom; UPDRS: Unified Parkinson's Disease Rating Scale; VAPP, Voice Activity and Participation Profile; V-RQOL: Voice-Related Quality of Life; VHI: Voice Handicap Index, 6MWT: Six-Minute Walk Test.

A total of 983 participants (46.89% female) were analyzed. The mean age of the participants was 68.10 years. Regarding the origin of the studies, 31.25% were conducted in Europe, 17.19% in Asia, 40.63% in America, and 10.93% Oceania.

The intervention providers were dance instructors (n= 13), psychotherapist (n=2), music therapists (n=6), art therapist (n=3), singing facilitators (n=1), drama therapist (n=1), professional coral (n=1), professional coach (n=1), art therapist and psychologist (n=1), music therapist and speech therapist (n=1), team of researchers (n=1) and unspecified (n=1). In one study they did not specify which professional carried out the intervention. The study settings were movement disorder center (n=3), community (n=25), movement disorder clinicals (n=2), long-term care centers (n=1) and voluntary groups and clinicians (n=1).

Interventions carried out were diverse: 16 studies included dance therapy, 3 music therapy, 6 singing therapy, 2 theatre, 1 study drama therapy and 4 visual art therapy (see **Supplementary file 6, Table 4**).

There were some differences regarding the type of control used: 8 studies included an active control group (Bae & Kim, 2018; Butala et al., 2022; Calabria et al., 2024; De Natale et al., 2017; Lee et al., 2024; Rios Romenets et al., 2015; Tamplin et al., 2020; Thaut et al., 2018); 3 studies included an active and passive control group (Hashimoto et al., 2015; Moratelli et al., 2023). In 4 studies participants received their usual care (Kunkel et al., 2017; Pohl et al., 2020; Shanahan et al., 2017; Solla et al., 2019). In 6 studies participants received their Passive (Bouquiaux et al., 2022; Cucca et al., 2021; Duncan & Earhart, 2014; Kalyani et al., 2019; Lee, H. J., Kim, S. Y., Chae, Y., Kim, M. Y., Yin, C., Jung, W. S., ... & Lee, 2018; Michels et al., 2018). In 12 studies there was no control group (Bega et al., 2017; Ettinger et al., 2023; Feenstra et al., 2022; Fisher et al., 2020; Fogg-Rogers et al., 2015; Han et al., 2018; Irons et al., 2021; Michels et al., 2018; Mondolfi, M. L., Savage, M., & Fernández-Aguayo, 2021; Prewitt et al., 2017; Schlesinger et al., 2014; Spee, B., Stap, T. B., Plijnaer, M., Pasman, G., Zeggio, S., Duits, A., ... & Koksma, 2025; Tunur et al., 2020).

3.3. Methodological Quality Assessment in Individual Studies

The quality of all the studies included is summarized (see **Supplementary files 7-10, Tables 5.a-5.d**). Overall, our analysis indicates that eleven studies had good methodological quality, 21 studies presented fair methodological quality and 1 study presented poor methodological quality.

On the one hand, the method of randomization was not reported in 8 studies and in other 9 studies the treatment allocation concealed not reported. On the other hand, participants and providers were not blinded to treatment group assignment in 12 studies and in 11 studies people assessing the outcomes were not blinded to the participants' group assignments. Besides, there

was no high adherence to the intervention protocols for each treatment group in 3 studies; the authors did not report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power in 10 studies. In addition, the outcomes not reported subgroups analyzed pre-specified in 2 studies, and in 1 study an intention-to-treat analysis was not performed.

3.4. Risk of bias

Risk of bias tool for all studies included in the meta-analysis can be seen in **Figure 3** (A, B and C) and **Supplementary files 11-15, Tables 6a, 6b, 7a, 7b and 8**.

Overall, the methodological quality of the included studies was heterogeneous. Most RCTs assessed with **RoB 2** showed "*high risk of bias"* (1/8 studies) or "*some concerns"* (3/8 studies). Particularly, 7 of 8 trials presented concerns in detection bias due to lack of blinding of outcome assessment, and attrition bias was evident, with one trial rated at high risk and three with some concerns. In addition, selective reporting raised some concerns in 3 of 8 trials. Non-randomized studies evaluated with **ROBINS-I** generally presented a "*moderate risk of bias" in all studies*, particularly due to residual confounding (6/9 studies), deviations from intended interventions (5/9 studies), and measurement of outcomes (5/9 studies), whereas missing data contributed to bias (3/9 studies). Only one study showed concerns in intervention classification and selective reporting. All single-group studies assessed with the **Newcastle Ottawa Scale** were rated as "*fair quality*", with the lowest scores observed in selection of a non-exposed cohort and lack of additional adjustments in the comparability domain. Nevertheless, sensitivity analyses and subgroup comparisons indicated that studies with lower methodological quality did not substantially influence the pooled estimates; effect sizes remained stable when excluding studies judged to be at high or serious risk of bias. Therefore, although the evidence should be interpreted with caution given these methodological limitations, the overall results appear robust to the risk-of-bias patterns identified.

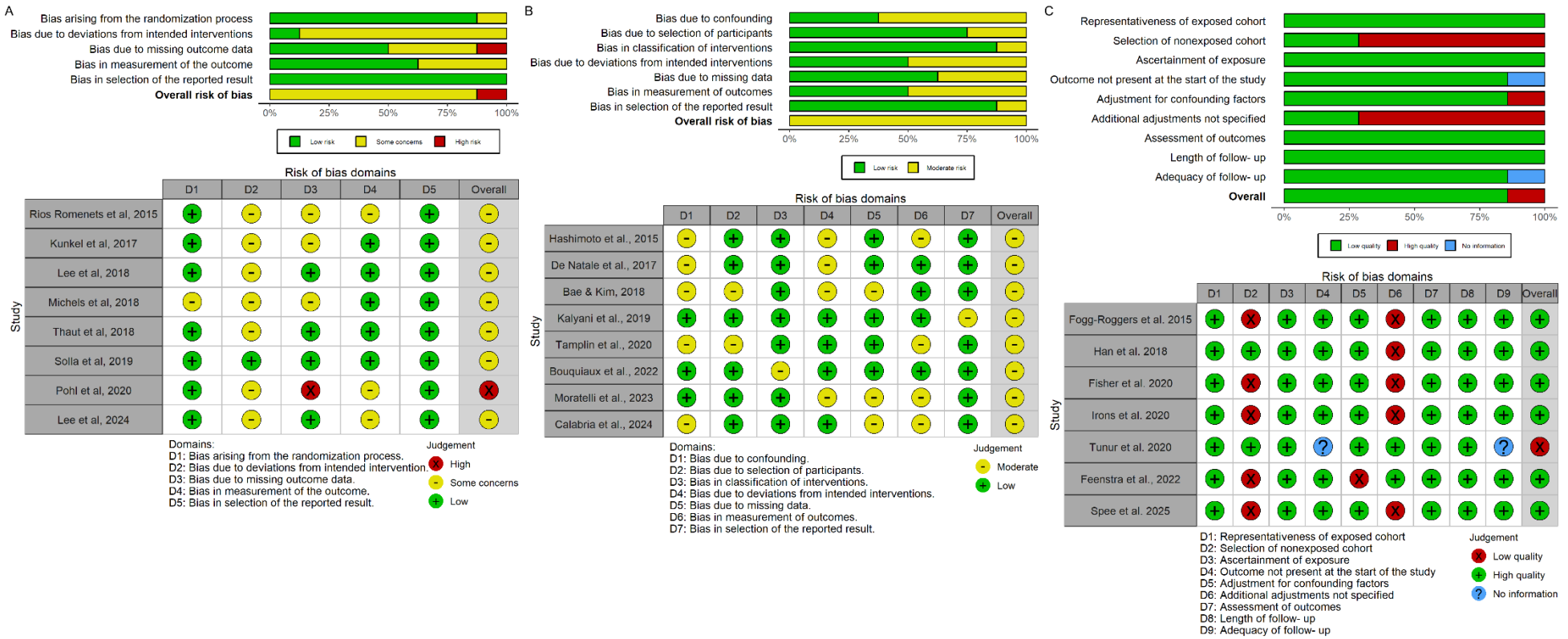


Figure 3. Risk of bias tool for randomized trials (A), Risk of bias in non-randomized studies of interventions (B) and Newcastle-Ottawa Scale (C) risk of bias assessment.

3.5. Narrative synthesis

Nine studies were included in the narrative synthesis of this review, which describes the effects of Art therapy on non-motor symptoms (cognitive and neuropsychiatric), motor symptoms, and QOL. These studies were not included in the meta-analysis, due to lack of data, despite contact with the authors.

3.5.1. Non-motor cognitive symptoms

Global cognition

One of the nine studies (Prewitt et al., 2017) employed dance therapy as an intervention and assessed global cognitive function using the SCOPA-COG; however, the results indicated no statistically significant differences.

Progression of Parkinson's Disease

Three of nine studies measured the progress of PD with the UPDRS (Cucca et al., 2021; Schlesinger et al., 2014; Shanahan et al., 2017), all of them showed significant differences. One of them based its intervention on music therapy (Schlesinger et al., 2014); other through dance therapy (Cucca et al., 2021) and other based on visual arts (Shanahan et al., 2017).

3.5.2. Non-motor neuropsychiatric symptoms

Depression

Two of nine studies evaluated depression using the BDI (Cucca et al., 2021; Mondolfi, M. L., Savage, M., & Fernández-Aguayo, 2021) without finding significant differences. One of them through dance therapy (Cucca et al., 2021) and the other with drama therapy (Mondolfi, M. L., Savage, M., & Fernández-Aguayo, 2021).

3.5.3. Motor symptoms

Balance

Of the nine studies measured changes in balance through dance therapy as part of their analyses using the Mini-BESTest (Duncan & Earhart, 2014; Shanahan et al., 2017); only one found significant improvements (Duncan & Earhart, 2014).

Endurance

Two of nine studies evaluated endurance applying dance therapy with the 6MWT (Duncan & Earhart, 2014; Shanahan et al., 2017), only one showed significant benefits (Duncan & Earhart, 2014).

Functional Mobility

Only one study of nine studies analyzed functional mobility using the TUG (Cucca et al., 2021), performed a visual arts intervention, however, no significant differences were found for this variable.

Motor Aspects

Three of the nine studies measured motor aspects through the UPDRS-III following a dance therapy intervention (Bega et al., 2017; Duncan & Earhart, 2014; Feenstra et al., 2022); only one obtained significant differences with dance therapy (Feenstra et al., 2022).

Freezing of gait

Only one study analyzed freezing of gait using the FOG questionnaire (Duncan & Earhart, 2014), performed a dance therapy intervention; nonetheless, no significant differences were obtained.

3.5.3. ADLs

Three of nine studies measured ADLs with the UPDRS-II, two studies through dance therapy (Duncan & Earhart, 2014; Prewitt et al., 2017) and one through theatre (Bega et al., 2017) and all obtained significant differences.

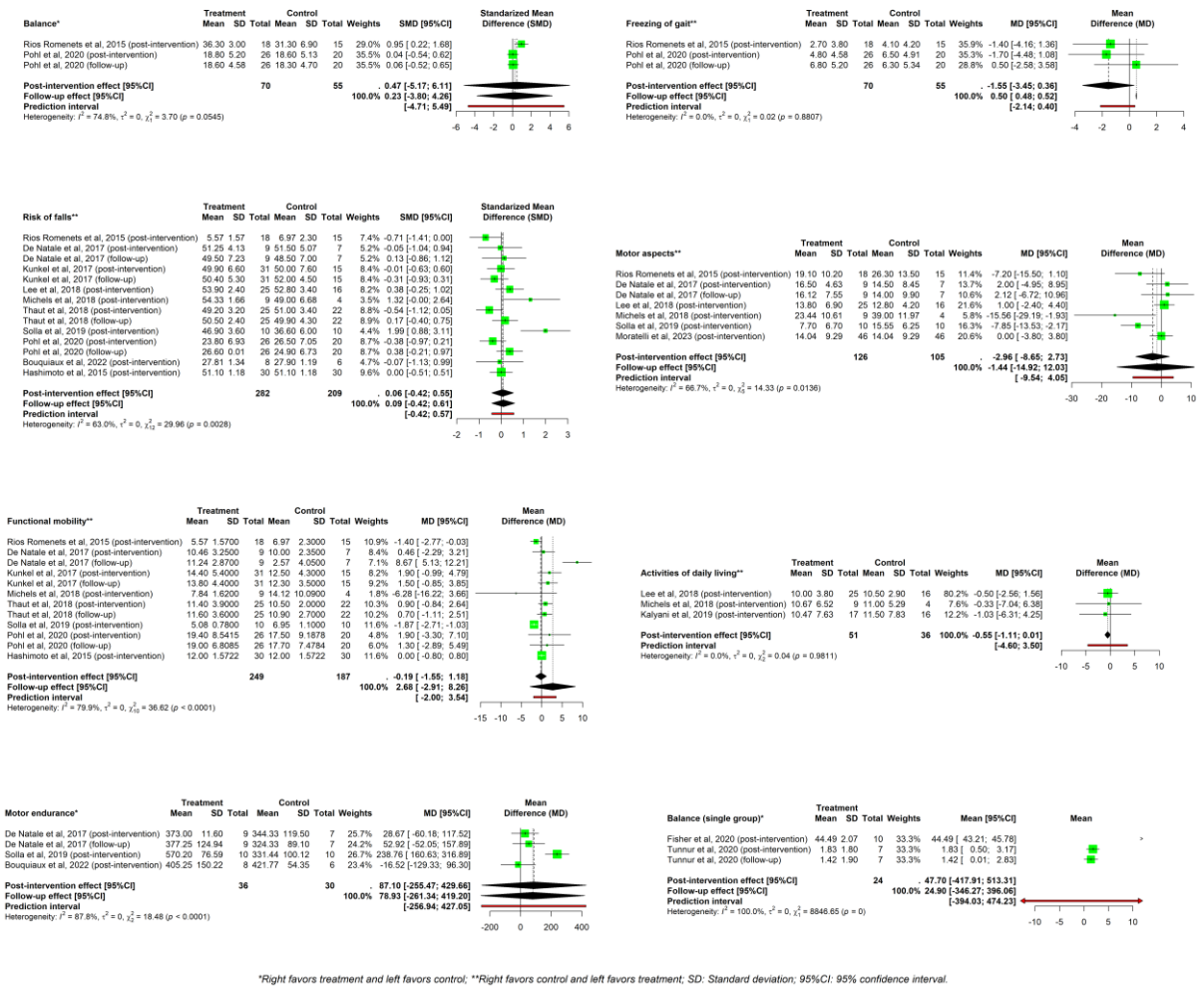
3.5.4. QoL

Five of nine studies focused on QoL using the PDQ-39 questionnaire applying dance therapy, (Butala et al., 2022; Feenstra et al., 2022; Shanahan et al., 2017), music therapy (Schlesinger et al., 2014) and theatre (Bega et al., 2017); only one based on dance therapy showed significant differences (Feenstra et al., 2022) .

3.6. Meta-analysis

3.6.1. Motor variables and ADLs

In the motor variables, no significant effect is evident except in the freezing of gait variable in the follow-up in which, the non-significant Cochrane's Q test ($X^2(2)= 0.023$, $p=0.881$) and the I^2 value [I^2=<0.001%, (τ^2=<0.001)] indicate non-significant heterogeneity with a moderate and significant effect size in favor of the CG [RVE (Mean)=0.500 95%CI(0.48, 0.52), Z=10.632, p<0.001] (**Figure 4**).



*Right favors treatment and left favors control; **Right favors control and left favors treatment; SD: Standard deviation; 95%CI: 95% confidence interval.

Figure 4. Motor variables forest plots**.**

3.6.2. Non-motor variables and QoL

In the cognitive variables, no significant effect is evident except in:

1)Attention in which the follow-up in which the non-significant Cochrane Q test ($X^2(2)=1.499$, p=0.473) and the I^2 value [I^2=0.003%, (τ^2=<0.001)] indicate non-important heterogeneity with a large and significant effect size in favor of the treatment group [RVE (Mean)=0.854 95%CI(0.834, 0.874), Z=10.892, p<0.001].

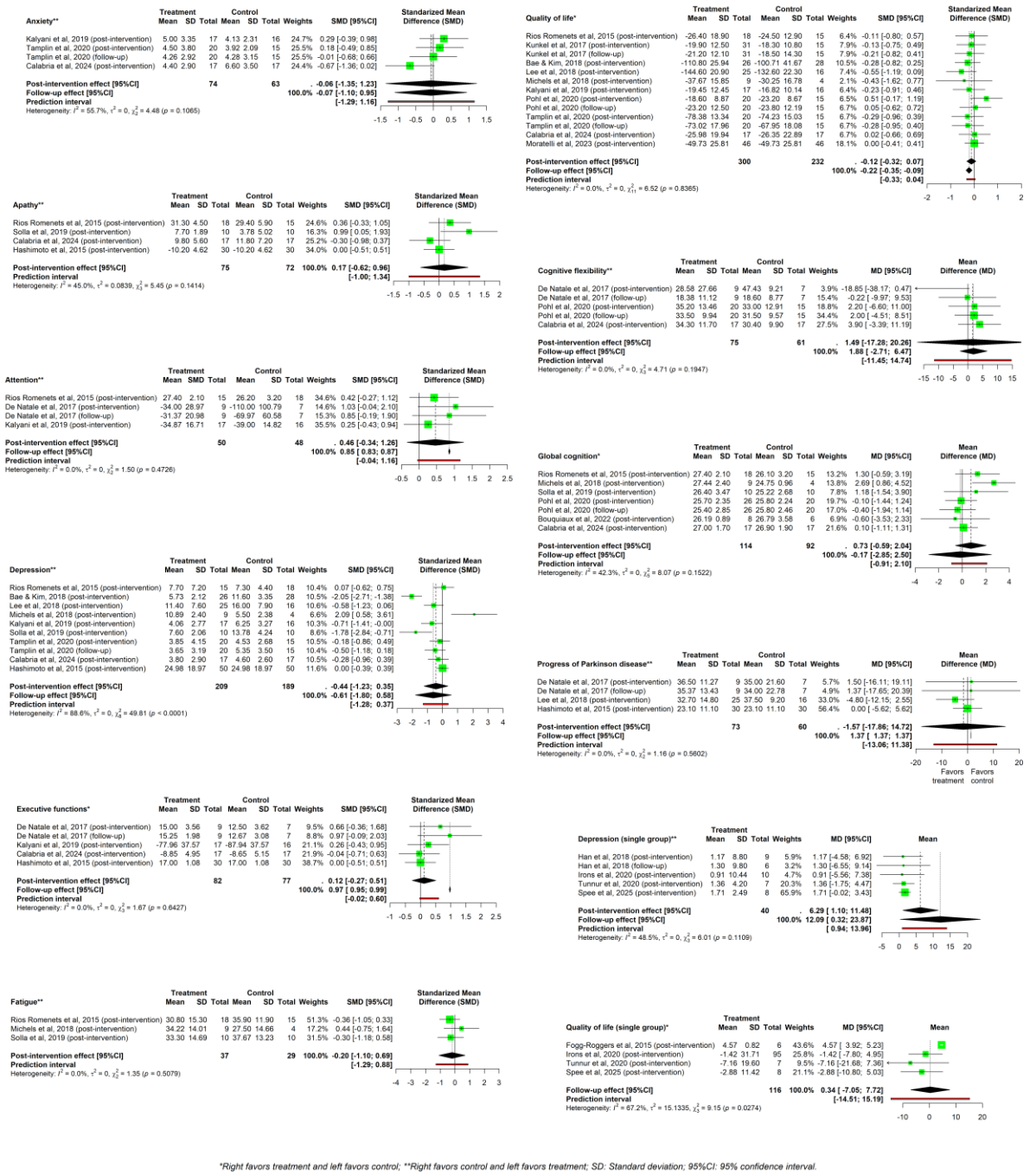
2) Executive functions in which the follow-up in which the non-significant Cochrane Q test ($X^2(3)=1.674$, p=0.643) and the value of I^2 [I^2=0.001%, (τ^2=<0.001)] indicate a non-significant heterogeneity with a large and significant effect size in favor of the treatment group [RVE (Mean)=0.971 95%CI(0.951, 0.991), Z=50.323, p<0.001].

Depression showed a large and significant effect size in the single-group studies, with a lower level of depression post-treatment [RVE (Mean)=6.289 95%CI(1.101, 11.477), Z=10.878, p=0.049] that increased in the follow-up [RVE (Mean)=12.094 95%CI(0.318, 23.871),

Z=10.878, p=0.049]. Although the Cochrane Q test is not significant ($X^2(3)=6.014$, p=0.111) the I^2 value [I^2=48.538%, (τ^2=<0.001)] indicates moderate heterogeneity.

QoL in the follow-up in which the Cochrane Q test is not significant ($X^2(11)=6.52$, p=0.837) and the I^2 value [I^2=0.001%, (τ^2=<0.001)] indicate a non-significant heterogeneity with a small and significant effect size in favor of the CG [RVE (Mean)=-0. 219 95%CI(-0.351, -0.087), Z=-6.347, p=0.017].

Progress of PD in the follow-up, in which the Cochrane Q test not significant ($X^2(2)=1.159$, p=0.56) and the value of I^2 [I^2=0.008%, (τ^2=<0.001)] indicate a non-significant heterogeneity with a large and significant effect size in favor of the CG [RVE (Mean)=1.37 95%CI(1.369, 1.371), Z= 25.264, p<0.001] (**Figure 5**).



*Right favors treatment and left favors control; **Right favors control and left favors treatment; SD: Standard deviation; 95%CI: 95% confidence interval.

Figure 5. Non-motor (cognitive and neuropsychiatric) variables and QoL.

3.6.3. Subgroup meta-analysis

There are significant differences in the variables motor aspects, depression, executive functions, and functional mobility in favor of the treatment group, and in the variables progress of PD and QoL in favor of the CG in the subgroups “age range”, “quality of studies”, “type of control”, and “type of Art therapy” with effect sizes ranging from moderate to large.

The moderator test indicates the presence of significant differences for the variables depression and global cognition across the different levels of the subgroups “type of control”, “origin of studies”, and “quality of studies”.

The analysis of the different levels of “age range”, “duration of intervention”, “origin of studies”, “type of control”, “quality of studies”, and “type of Art therapy” shows the presence of significant differences in the variables depression, global cognition, and risk of falls in favor of the treatment group, and in the variable functional mobility in favor of the CG specifically:

- depression at the levels 50-69 years, medium-term intervention, Europe, fair quality, passive control and usual care;
- functional mobility at the levels 50-69 years, short-term intervention, Europe, fair quality, dance therapy, active control and passive control;
- global cognition at the level America and fair quality;
- risk of falls at the level music therapy.

Effect sizes are moderate to large, without a clear pattern in the modification of heterogeneity when controlling for subgroups (significant results are shown in red) (**Table 3** and **Supplementary files 16 and 17, Tables 9 and 10**).

Table 3. Subgroups significant results and moderator test.

Outcome variable	Grouping variable	Outcome level	Overall outcome ([a]p value)	Overall I^2	Moderator test ([a]p value)	Grouping level	Subgroup outcome ([a]p value)	Subgroup I^2
Motor Aspects	**Age range**	70 years and older	-13.176 (SE=1.682), 95%CI(-17.618, -8.733), t(4.59)=-7.833, p=0.001	54.396				
Depression	**Age range**	Post-intervention				*50-69 years*	-0.444 (SE=0.223), 95%CI(-0.881, -0.007), z=-1.991, p=0.046	63.064
	Duration of intervention	Post-intervention				*Medium-term intervention*	-0.387 (SE=0.181), 95%CI(-0.743, -0.032), z=-2.135, p=0.033	51.905
	Origin of studies	Post-intervention				*Europe*	-0.648 (SE=0.308), 95%CI(-1.252, -0.043), z=-2.101, p=0.036	62.302
	Quality of studies	Follow-up	-0.514 (SE=0.061), 95%CI(-0.901, -0.128), t(1.454)=-8.373, p=0.033	88.863				
	Type of control	Follow-up	-0.5 (SE=0), 95%CI(-0.5, -0.5), t(1.169)=-231777.909, p<0.001	0.003	$X^2(4)=53.097$, p<0.001			
		Passive			$X^2(4)=53.097$, p<0.001			
		Post-intervention			$X^2(4)=53.097$, p<0.001	*Usual Care*	-1.969 (SE=0.284), 95%CI(-2.524, -1.413), z=-6.943, p<0.001	0
		Usual Care	-1.9 (SE=0.142), 95%CI(-2.739, -1.062), t(1.517)=-13.428, p=0.015	0.003	$X^2(4)=53.097$, p<0.001			
Executive functions	**Type of control**	Follow-up	0.971 (SE=0), 95%CI(0.971, 0.971), t(1)=99405.748, p<0.001	0.005				
Functional mobility	**Age range**	Follow-up				*50-69 years*	8.479 (SE=1.996), 95%CI(4.567, 12.392), z=4.247, p<0.001	64.731
	Duration of intervention	Follow-up				*Short-term intervention*	4.786 (SE=2.326), 95%CI(0.227, 9.345), z=2.058, p=0.04	85.102
	Origin of studies	Follow-up				*Europe*	3.747 (SE=1.756), 95%CI(0.305, 7.189), z=2.134, p=0.033	80.173
	Quality of studies	Follow-up				*Fair quality*	8.598 (SE=1.906), 95%CI(4.863, 12.333), z=4.512, p<0.001	35.633
	Type of Art therapy	Follow-up				*Dance therapy*	4.571 (SE=1.761), 95%CI(1.119, 8.022), z=2.596, p=0.009	86.21
	Type of control	Follow-up				*Active*	4.079 (SE=1.968), 95%CI(0.223, 7.936), z=2.073, p=0.038	89.767
						Passive	-6.531 (SE=0.65), 95%CI(-8.432, -4.631), t(3.542)=-10.051, p=0.001	82.519

Outcome variable	Grouping variable	Outcome level	Overall outcome ([a]p value)	Overall I^2	Moderator test ([a]p value)	Grouping level	Subgroup outcome ([a]p value)	Subgroup I^2
Global cognition	**Origin of studies**	Europe			$X^2(3)=9.348$, p=0.025			
		Follow-up			$X^2(3)=9.348$, p=0.025			
		Post-intervention			$X^2(3)=9.348$, p=0.025	*America*	2.016 (SE=0.695), 95%CI(0.654, 3.377), z=2.901, p=0.004	6.937
	Quality of studies	Follow-up			$X^2(3)=9.348$, p=0.025			
		Good quality			$X^2(3)=9.348$, p=0.025			
		Post-intervention			$X^2(3)=9.348$, p=0.025	*Fair quality*	2.016 (SE=0.695), 95%CI(0.654, 3.377), z=2.901, p=0.004	6.937
Progress of Parkinson´s disease	**Type of control**	Follow-up	1.37 (SE=0), 95%CI(1.37, 1.37), t(1)=162992.618, p<0.001	0.003				
Quality of life	**Type of Art therapy**	Music therapy	0.6 (SE=0.131), 95%CI(0.214, 0.986), t(3.463)=4.59, p=0.014	0.001				
Risk of falls	**Type of Art therapy**	Post-intervention				*Music therapy*	-0.459 (SE=0.211), 95%CI(-0.873, -0.045), z=-2.174, p=0.03	0.002

SE: Standard error; 95%CI: 95% confidence interval.

[a]significant if p<0.05 (shown in red).

3.7. Publication bias

Egger's test is not significant except for the variables Cognitive flexibility, Depression (single group), QoL (single group), Balance (single group), Motor aspects, Risk of falls (significant results are shown in red) (see **Supplementary file 18, Table 11**). On the other hand, the funnel plots show a symmetrical distribution of the studies around the axis, which indicates the absence of publication bias, except in the studies on QoL with an RCT design, in which a clear asymmetry is observed in their distribution (see **Supplementary file 19 and 20, Figures 3 and 4**).

4. Discussion

This systematic review and meta-analysis aimed to assess the impact of Art therapy (either alone or in combination with pharmacological treatment for PD, particularly levodopa) on variables related to non-motor symptoms (cognitive and neuropsychiatric), motor symptoms, ADLs and QoL in younger and older adults with PD.

In contrast to previously published studies, our research has assessed the impact of different types of Art therapy introducing not only music and dance, but also theatre, drama, singing and visual arts in PD on non-motor and motor variables, ADLs and QoL. In addition, we have analyzed different subgroups that previous studies have not evaluated, such as the participants´ age, duration and type of Art therapy, type of control, quality of studies, origin of the studies (according to the participants´ continent of origin).

Our results indicate that **Art therapy interventions**, particularly dance therapy, **can improve executive functions** and **attention** in older adults with PD).

1. Executive Functions

Participants undergoing Art therapy showed significant improvements in executive functions [RVE (Mean)=0.971, 95% CI(0.951, 0.991), Z=50.323, p<0.001]. As was the case for attention, the study showing the greatest effects was De Natale et al. 2017, despite a relatively small sample. Their intervention was brief but well structured, consisting of 20 sessions of 60 minutes each, delivered twice per week over 10 weeks. Each session included a 5–10-minute musical warm-up, progressive learning of Argentine Tango steps following established protocols, and 5–10 minutes of free partnered dancing to consolidate newly learned skills.

Although these improvements are promising, they should be interpreted cautiously due to heterogeneity across the four studies included in this analysis, which varied in participant age (63.9–68 years), disease duration (4.85–9.4 years), type of intervention (dance, theater, physical exercise, traditional rehabilitation, passive control, or cognitive stimulation), and session

duration/frequency (60–120 minutes per session, 1–2 times per week, over 10–24 weeks). This variability may influence the stability and generalizability of the observed effects.

In agreement with our results, Zhang et al. 2019 (Zhang et al., 2019) also found similar effects through dance therapy (WMD=1.17, 95% CI:0.39 to 1.95, P=0.003; I^2=0%, P=0.45) They analyzed only RCTs (two of which are also included in the current meta-analysis), with a setting similar to that of our study, and participants' mean age and disease duration also comparable. However, the comparison groups received non-dance interventions, usual care, or no intervention. In contrast, Lee et al. 2022 (Lee, H., & Ko, 2022) reported no significant improvement in inhibitory control after applying music therapy (SMD= 0.07, 95% CI= 0.40~0.55, p = 0.76). Their meta-analysis included only RCTs and controlled clinical trials, with a mean age range similar to our sample, slightly less advanced disease, and a setting (clinic, hospital, or home) similar to that of our study. The control groups received non-music interventions, usual care, or no treatment.

Research on cognition in PD indicates that the disease can affect all cognitive domains; with executive dysfunction being particularly pronounced (Stuss, D. T., & Alexander, 2000). Executive function deficits in PD are associated with gait disturbance, freezing, and postural instability (Kelly, V. E., Johnson, C. O., McGough, E. L., Shumway-Cook, A., Horak, F. B., Chung, K. A., ... & Leverenz, 2015) and difficulties in ADLs (Kudlicka et al., 2018). These functions are crucial for planning, monitoring and performing complex actions, coordinating other cognitive domains, and supporting functional recovery (De Luca et al., 2019). Therefore, specific training to improve executive functions is important in PD (Sammer, G., Reuter, I., Hullmann, K., Kaps, M., & Vaitl, 2006), and art-based interventions represent a promising non-pharmacological approach that is gaining attention as an innovative treatment (Y. Li et al., 2024).

2. Attention

Attention, which has not been systematically evaluated in previous meta-analyses of art therapy in PD, also improved following dance interventions. Similar to executive functions, the study showing the greatest benefits was De Natale et al. 2017. Improvements in attention may result from engagement of neural networks involved in visuospatial processing, global attention, memory, and complex task planning—systems affected in PD. Participation in artistic activities may also stimulate the mesolimbic reward system, potentially increasing dopamine levels and enhancing attentional performance (Gros et al., 2024).

Evidence from studies in MCI supports the efficacy of dance interventions for attention (SMD=0.33, 95% CI: 0.09–0.57) and executive function (SMD=-0.34, 95% CI: -0.56 to -0.12), suggesting that similar strategies could benefit individuals with PD (Huang, C. S., Yan, Y. J.,

Luo, Y. T., Lin, R., & Li, 2023). These interventions may also help delay progression to more severe cognitive decline, suggesting that baseline cognitive status may influence responsiveness to Art therapy.

On the other hand, significant changes in **depressive symptoms** were observed after **the application of Art therapy in single-group studies**, with symptoms showing a reduction immediately after the intervention but increasing at follow-up. These findings should be interpreted with caution due to substantial heterogeneity among the studies. The evidence comes from four studies—two on singing therapy, one on dance therapy, and one on visual arts—using different assessment tools. Participants' ages ranged from 54.5 to 69.7 years, with disease duration between 4.8 and 6.9 years. Intervention protocols varied in session length (20–120 minutes), frequency (1–3 times per week), and total duration (2 weeks to 6 months), contributing to methodological variability and limiting the generalizability of the results.

We did not identify any meta-analysis combining singing therapy, dance, and visual art in patients with PD that would allow direct comparison with our findings. However, related evidence from meta-analyses focused on dance interventions provides some context. For example Wang et al. 2022 (Wang, L. L., Sun, C. J., Wang, Y., Zhan, T. T., Yuan, J., Niu, C. Y., ... & Cheng, 2022) reported that dance therapy did not produce significant improvements in depression (MD = - 1.33, 95% CI [- 4.11, 1.45], P = 0.35; I^2 = 79%) and similar non-significant results were observed by Zhang et al. 2019 (Zhang et al., 2019) (MD = - 0.39, 95% CI [4.10, 3.31], P = 0.84; I^2 = 78%). In contrast, evidence from a large network meta-analysis indicates that dance can significantly improve depressive symptoms in patients with PD, outperforming several other non-pharmacological interventions. Across multiple pairwise comparisons, dance showed meaningful reductions in depression relative to occupational activities, stretching, and treatment as usual.

Contrary to the previous results, significant improvements in freezing of gait, Qol and PD progression were observed in the control groups compared to the Art therapy intervention groups. This pattern can be explained by the nature of the control conditions.

1) Freezing of gait: One study evaluated dance therapy and another music therapy; each compared against an active control (exercise or usual care). Notably, the greatest improvements were observed in the study by Pohl et al. 2020 (Pohl et al., 2020), where music therapy was compared to usual care, highlighting that active interventions can produce meaningful benefits.
2) PD progression: All three studies applied dance therapy, with outcomes compared against active controls (physical exercise or traditional rehabilitation) and passive controls. The largest effect was reported by De Natale et al. 2017 (De Natale et al.,

2017), in which dance therapy was compared to traditional rehabilitation. These findings suggest that structured active control interventions can also promote functional improvements and influence disease progression.

3) QoL: Nine studies evaluated art-based interventions in patients with PD: six assessed dance therapy, one singing therapy, one music therapy, and one visual arts. Control conditions included four passive controls, two usual care, one cognitive stimulation, one rehabilitation program, one dance, painting, or Tai Chi classes adapted for PD aimed at socialization, and one combining forró, samba, and play activities for social and cognitive-motor stimulation. One study included both an active and a passive control group. The largest improvements in QoL were reported by Pohl et al. 2020 (Pohl et al., 2020), where music therapy was compared to usual care, again highlighting the potential impact of active controls.

In line with our findings Carapelloti et al. 2020 (Carapellotti et al., 2020) reported that dance vs active control (such as physiotherapy and educational programs) did not produce significant effects on freezing of gait (FOG-Q: MD = −1.94, 95% CI = −4.33 to 0.46, p = 0.11). The following meta-analyses summarize the impact of various exercise modalities in PD:

1- Yang et al. 2022 (Yang et al., 2022) included therapeutic exercise interventions for PD demonstrated that power training yielded the greatest improvements in **motor symptoms** compared with control groups (SMD = –1.46; 95% CrI: –2.18 to –0.74).

2- Peng et al. 2024 (Peng et al., 2024) showed that Oriental Exercises, showed significant improvements in **non-motor symptoms** and QoL in PD patients.

3- Li et al. 2023 (J. A. Li et al., 2023) reported that exercise interventions improved PD progression- UPDRS motor scores (Hedges' g = −0.39, 95% CI: −0.65 to −0.13, P = .003).

4- García Sena et al. 2023 (Sena et al., 2023) found that high-intensity exercise compared with control led to improvements in **disease severity** (MD = −4.80; 95% CI: −6.38 to −3.21, high evidence certainty) and **QoL** (MD = −0.54; 95% CI: −0.94 to −0.13, moderate evidence certainty).

These findings suggest that exercise and therapeutic interventions can contribute to improvements in motor symptoms, PD progression and QoL in patients with PD. Therefore, non-pharmacological interventions may positively affect multiple domains of the disease (Fox et al., 2018), with motor symptoms particularly highlighted by freezing of gait (Lichter et al., 2021); as it affects approximately 15–25% of early PD cases (Zhang et al., 2016).

Age, duration of the intervention, type of art therapy, type of control, origin of the studies, and study quality are important moderators. In the subgroup analyses, positive outcomes

were observed in specific contexts, suggesting that benefits may be limited to certain patient profiles or intervention characteristics. Age was associated with outcomes in motor aspects, depression, and functional mobility. The duration of the intervention showed medium-term effects for depression and short-term effects for functional mobility. Regarding the type of control, depression outcomes were compared with passive controls, whereas functional mobility outcomes were evaluated against both active and passive controls. The origin of the studies revealed that European studies focused on global cognition and functional mobility, while American studies mainly addressed global cognition. Study quality ranged from fair for functional mobility outcomes to good and fair for global cognition outcomes. Finally, the type of art therapy varied, with dance interventions targeting functional mobility and music interventions addressing risk of falls. Overall, these findings highlight the importance of considering these moderators when interpreting the effectiveness of art therapy interventions, as their impact may depend on patient characteristics, study design, and the specific modality applied. Some meta-analyses have specifically examined dance therapy in PD, highlighting its particular relevance. For instance, Liu et al. 2025 (Liu et al., 2025) found that dance therapy produced the most significant improvements in motor function (motor symptom, functional mobility and balance; Zhang et al. 2019 (Zhang, Q., Hu, J., Wei, L., Jia, Y., & Jin, 2019) reported benefits in executive function; while Wang et al. 2022 found improvements in global cognition. More recently, Barnish and Barran 2025 (Barnish, M. S., Reynolds, S. E., & Nelson-Horne, 2025) as part of an updated meta-analysis of group-based performing arts demonstrated a clinically meaningful benefit for PD-specific dance compared to usual care in terms of QoL and in tango-based dance, relative to usual care, in motor symptoms.

Although this investigation did not find significant effects significant differences in favor of Art therapy for: 1) non-motor cognitive variables such as global cognition, and cognitive flexibility; 2) non-motor neuropsychiatric variables such as fatigue, apathy and anxiety; 3) motor variables such as risk of falls, motor aspects, functional mobility, endurance and balance and 4) ADLs; other meta-analysis have reported mixed results. On the one hand, several studies—consistent with our findings—reported no significant effects of dance therapy on fatigue and apathy (Wang et al., 2022), on mood when compared with active controls (Cheng et al., 2024), and on both QoL and motor symptoms in comparisons of dance versus active control groups (Carapellotti et al., 2020); as well as no significant effects of music therapy on cognitive flexibility and QoL (Lee, H., & Ko, 2023). On the other hand, significant effects have been reported in other studies using dance therapy, including improvements in functional mobility (Karpodini et al., 2022), as well as in comparisons of dance versus both no intervention and active control groups (Carapellotti et al., 2020). Positive effects were also found for motor

symptoms (Ismail et al., 2021; Karpodini et al., 2022), motor symptoms in dance vs. no intervention (Carapellotti et al., 2020; Sharp & Hewitt, 2014), balance (Ismail et al., 2021), balance in dance vs. no intervention: (Carapellotti et al., 2020; Sharp & Hewitt, 2014), endurance in dance versus no intervention (Carapellotti et al., 2020), and functional mobility and QoL in dance versus active control (Carapellotti et al., 2020). In addition, significant improvements in quality of life and motor symptoms were observed in studies where no group had a control (Barnish, M. S., Reynolds, S. E., & Nelson-Horne, 2025), global cognition (Wang et al., 2022) and mood (anxiety and depression) in comparisons of dance versus passive controls ((Cheng et al., 2024). Moreover, music therapy has demonstrated positive effects on functional mobility (Lee, H., & Ko, 2023), and Art therapy has shown benefits in motor symptoms, functional mobility, balance, and endurance (Liu et al., 2025).

Clinically, the overall evidence suggests that performing arts–based interventions—especially dance and music—may be most beneficial as complementary approaches to target motor and functional outcomes in Parkinson's disease. While the present study did not find improvements with art therapy across cognitive, neuropsychiatric, motor, or functional domains, several meta-analyses show consistent benefits of dance and music for mobility, balance, endurance, and motor performance. By contrast, effects on cognition, fatigue, apathy, or mood are less consistent and often dependent on whether the comparison group is passive or active. Therefore, these interventions may be best integrated into rehabilitation programs with the primary aim of improving motor functioning and QoL, whereas cognitive or neuropsychiatric symptoms may require other specialized therapeutic strategies.

Strengths and limitations

This study underscores the methodological strength of incorporating a broad spectrum of Art therapy modalities, as well as accounting for the heterogeneous symptomatology associated with PD. Furthermore, unlike other studies, subgroup analyses were conducted based on the type of Art therapy, participants' age, type of control group, duration of the intervention, country where the study was conducted, and the quality of the included studies.

However, the study has several limitations. Firstly, the majority of studies included in this review showed small sample sizes (only 3 studies had samples larger than 50 participants) and the mean disease duration was different (between 4.45±3.2 and 11.05±5.5). Secondly, not all of the selected studies could be included to contribute to the meta-analysis, this limited the ability to perform all combinations of subgroups and in particular to analyses which type of Art therapy worked best in relation to the different symptoms. Furthermore, for some variables only had three studies endurance, ADLs, fatigue, anxiety, progress of PD, cognitive flexibility and attention) and only two studies for freezing of gait and balance. Thirdly, only 11 studies had

good quality. Fourthly, in relation to risk of bias: randomized trial studies had lower scores in "blinding of outcome assessment"; in non-randomized trial studies the majority scored with "some concerns" in bias due to confounding and bias due to deviation from intended interventions and in single group studies the lowest score was in "selection of no exposed cohort" and "compatibility-additional adjustment not specified". In addition, the study included only English and Spanish (only one) literature, which may increase the risk of bias publication.

5. Conclusion

Our findings suggest that Art therapy improves executive functions and attention in older adults with PD. Dance therapy can be recommended as a particularly effective approach for adults under 70 years of age who are in non-advanced stages of the disease. The most beneficial interventions were brief but well-structured, typically consisting of 20 sessions of 60 minutes each, delivered twice per week over a period of 10 weeks, administered by dance instructors. Additionally, improvements observed in freezing of gait, PD progression, and QoL in the control groups underscore the effectiveness of structured active interventions, such as exercise, rehabilitation, or usual care. Overall, physical and dance-based exercises represent valuable complementary strategies for managing both motor and non-motor symptoms in PD, and future studies should investigate which patient profiles and intervention characteristics maximize these benefits.

High-quality studies that include larger sample sizes and with statistical analyzes in which data are provided for inclusion in meta-analyses are needed to draw conclusions about Art therapy on other non-motor and motor symptoms, as well as ADLs. Future research should also aim to independently examine the effects of different types of Art therapy across various outcome measures, in order to identify the most effective approaches and to compare each intervention separately against both passive and active control groups. This would enable a clearer understanding of the true impact of non-pharmacological interventions on the control groups and whether these effects might exceed those observed in the primary intervention groups in both younger and older adults living with PD.

Clinical Implications:

- Structured art-based therapies, particularly dance programs, may be offered as adjunctive interventions to support executive function and attention in older adults with Parkinson's disease.
- Clinicians should set realistic expectations, as current evidence does not show consistent benefits of art therapy for other motor and non-motor outcomes, activities of daily living, or sustained improvements in depressive symptoms.

- When implementing art therapy, brief, engaging, and supervised interventions delivered by trained professionals should be prioritized and considered alongside other active, structured treatments such as exercise or rehabilitation.

Disclosure statement

The authors declare that they have no conflicts of interest.

IRB protocol/human subject's approval

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Declaration of Competing Interest

The authors declare no competing interests.

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Data Availability Statement

The data that support the findings of this study are derived from published articles and supplementary materials. The extracted data and analytic files used for the meta-analysis (e.g., data extraction sheet and effect-size calculations) are available from the corresponding author upon reasonable request. Any additional study-level data received from original authors will be shared upon reasonable request, subject to the terms under which they were provided and any ethical, privacy, or data protection restrictions.

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