

TITLE

Effects of Partnered Dance in People with Parkinson's (PWP) - A scoping review

Lead author: Ms. Ting Ka Cheng

Co-author: Ms. Sarah Sessa

Work Address: N.A.

Email: Leannecheng264@gmail.com

Phone details: +852 6712 6644

Social media: LinkedIn: Leanne Cheng

Professional and academic qualifications of all authors:

Ms. Ting Ka Cheng, BSc (Hons) Physiotherapy (2023), School of Health and Social Wellbeing, University of the West of England, Bristol, U.K.

Current Position: Qualified Physiotherapist

Ms Sarah Sessa, MSc, PGCert TLHE, BSc (Hons), MCSP, FHEA

Senior Lecturer in Neurorehabilitation, School of Health and Social Wellbeing,
University of the West of England, Bristol, U.K.

ABSTRACT

Background: Partnered dance has been evidenced as beneficial for people with Parkinson's (Osborne *et al.*, 2022, Radder *et al.*, 2020, Keus *et al.*, 2014). However, the details are still ambiguous with regard to how partnered dance and its components impact PWP.

Objectives: This Scoping Review (ScR) aims to summarize the effects of partnered dance on PWP physically, psychologically, and cognitively, and the effects exerted by cueing, types of partners, and leading professionals. This review hopes to outline current related research findings and to identify research gaps for future research.

Data sources: Major electronic databases including PubMed, CINAHL, COCHRANE Web of Science, EMBASE, MEDLINE, and Grey literature including Google Scholar and Open Grey, were searched from November 2022 until March 2023.

Study selection: Of the primary studies included in the search, 12 were selected; seven randomized control trials (RCT), one non-RCT, one pilot study, one proposal, one interview, and one single-group pre-post design.

Methodology: PCC (Population, Concept, Context) was used to generate the search strategy. Researchers were divided into groups of two and three to initially screen titles and abstracts, followed by a comparison of the full-text against the inclusion and exclusion criteria. The studies selection process was recorded in the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISM-ScR).

Results: Four main themes were identified: 1) effects of partnered dance on PWP were identified by all 12 studies 2) types of cueing were identified by nine studies, 3) types of partners were identified by 10 studies, and 4) types of leading professionals were also identified by 10 studies.

Conclusion: PWP benefit from partnered dance physically (through improved initiation of movement, balance, and gait), and psychologically by providing reassurance, promoting socialization, and enhancing participation. Additionally, cueing provided by partners can alleviate freezing of gait and partners positively affect the PWP's dance classes experience. Although most studies mentioned the leading professionals, none discussed how different leading professionals affect PWP. None of the included articles discussed whether or how different leading professionals would affect PWP, highlighting the need for further investigations.

KEYWORDS

Partnered dance, Dance, Parkinson's, Rehabilitation, Cueing

INTRODUCTION

Parkinson's is a progressive neurodegenerative disorder, the main movement symptoms being caused by the loss of dopaminergic neurons in the substantia nigra (SN) disrupting basal ganglia (BG) functions (Surmeier, 2018). Dopamine deficiency causes motor dysfunction: primarily bradykinesia, resting tremors, and rigidity, and non-motor symptoms including sensory difficulties, cognitive impairment, and psychosocial changes (Kalia and Lang, 2015). As the Parkinson's pathology progresses, activities of daily livings (ADLs) are reported as becoming increasingly

difficult, PWP are recorded as experiencing diminishing motivation to engage in social activities, increasing reliance on others (Shulman *et al.*, 2008), and reducing physical function (Zafar, Bozzorg, and Hackney, 2017). Moreover, Foster and Hershey (2011) suggested that restricted participation in ADLs results in reduced QoL (Duncan and Earhart, 2011) and life satisfaction (Edwards *et al.*, 2006). Therefore, Parkinson's is also associated with a lower quality of life (QoL) and high socioeconomic cost (Gumber, Ramaswamy, and Oranuch, 2019). This relationship highlights the importance of pursuing interventions that improve symptoms and enhance participation in ADLs.

Current treatment for Parkinson's includes a combination of pharmacological and non-pharmacological options (National Institute for Health and Care Excellence, 2017), for example, dopaminergic therapy and deep brain stimulation (Lindenbach and Bishop, 2013), or antiparkinsonian medication and physical interventions (Keus *et al.*, 2014). With regards the pharmacological approach, Dopaminergic therapy neither prevents progressive disability (Chaudhuri, Healy and Schapira, 2006), nor does it adequately address the low participation factors reported by PWP including depression (Rascol *et al.*, 2003). Medication effectiveness also decreases as Parkinson's progresses and may lead to side effects such as severe on-off fluctuations and drug-induced dyskinesia (Lindenbach and Bishop, 2013).

Exercise, however, has been proven to positively impact the Parkinson's motor symptoms, particularly gait, balance and ability to perform ADLs (Osborne *et al.*, 2022, Radder *et al.*, 2020). If performed at sufficient intensity and regularity, exercise may improve functional circuitry by increasing synaptic strength and influencing

neurotransmission, therefore slowing the disease progression, demonstrating a neuroprotective role of exercise (Ellis and Rochester, 2018). As personal preference to different types of exercise affects consistent participation, especially if a traditional exercise style is not enjoyed (Jancey *et al.*, 2007; Qutubuddin *et al.*, 2007), broadening the availability of styles to remain physically active, such as Tai Chi, dance, and yoga might increase adherence to exercise (Kabra *et al.*, 2018; Houston and McGill, 2011).

Dance therapy has positive effects on motor impairment, endurance, balance, gait, and QoL (Sharp and Hewitt, 2014). It encourages social interaction, promotes adherence, and fosters motivation to participate (Federici, Bellagamba, and Rocchi, 2005). One author currently runs dance classes locally for PWP but only single person routines are taught. The authors wanted to explore whether dancing with a partner would provide increased benefit in terms of outcomes.

In terms of the neuroanatomical effect, a positron emission tomography (PET) study suggested that the BG might be sensitive to the interactions among entrainment (co-ordination or synchronisation of rhythms), meter (counting), and spatial patterning (relating to the relationship of the dancer to objects or people in their environment), specifically seen in dance (Brown, Martinez and Parsons, 2006), with potentially interesting implications for PWP where BG function is disrupted. Navigating movements, maintaining attention, and making decisions simultaneously provide the opportunity for multitasking (Earhart, 2009). Music also acts as an auditory cue and boosts the reward system, releasing more dopamine via the ventral tegmental area to improve mood, motivation, and cognition (Rios Romenets *et al.*, 2015; Hackney

and Earhart, 2009). Keus *et al* (2014) suggest that partnered dance shows benefits for improving gait and reducing the risk of falls in PWP.

When considering different styles of dance, Tango movements have been shown to enhance motor abilities by targeting Parkinson-related impairments, including initiation, spontaneous directional changes, and speed changes, thus alleviating difficulties with movement initiation, turning, and bradykinesia (Lötzke, Ostermann and Bussing, 2015). In comparison, ballroom dance does not include backward and cross-stepping, allowing less able participants to be involved in the class (Kunkel *et al.*, 2017). Dancing with a partner promotes social and personal relationships while also improving physical limitations like axial impairments and dynamic balance (McNamara, Durso, and Harris, 2006). A study by De Dreu, Kwakkel, and Van Wegan (2015) stated the benefits of different types of partnered dance and cueing, however, the respective changing effects caused by different types of dance are not mentioned.

There are several established dance organizations for PWP, including Dance for PD (New York), Dance for Parkinson's (London), and Queensland Ballet. Neither the research nor information from dance organizations make clear the critical aspects for understanding the effects of partnered dance on PWP. Moreover, studies focusing on the partner's importance and influence remain ambiguous as demonstrated in a single group pre-post design study by Koch *et al.*, (2016). Identifying themes across studies is critical for understanding the effects of partnered dance on PWP. A ScR is an approach for synthesizing research evidence (Pham *et al.*, 2014) and aims to map and appraise current evidence and gaps to stimulate future change in practice,

policies, and studies (Aromataris and Riitano, 2014). This ScR encompasses different study designs, so a wide range of effects on PWP can be extracted, with mapping and engagement of the diverse research landscape (Arksey & O'Malley, 2007).

Aims

This Scoping review (ScR) aims to summarize the effects of partnered dance on PWP physically, psychologically, and cognitively, and explores the effects exerted by cueing, partners, and leading professionals on PWP. In addition, current findings and gaps for future research will be summarized.

METHOD

This ScR uses a combination of the Arksey and O'Malley framework (2007), the Joanna Briggs Institute (JBI) approach (Peters *et al.*, 2020) and guidance from the Preferred Reporting Items for Systematic and Meta-Analyses Extension for Scoping reviews (PRISMA-ScR) (Tricco *et al.*, 2018) to establish an understanding of relevant terminology, concepts, and key items to report (Sarkis-Onofre, 2021).

Eligibility Criteria

The Population, Concept, Context (PCC) framework (Table 1) is recommended by JBI to identify the main concepts in the review questions to develop a full search strategy.

Element	Description
Population	- PWP
Concept	- Interventions: Partnered dance - Outcomes: - Effects-Physically, Psychologically and Cognitive
Context	- Primary health setting - Community - Dance room/ dance class

Table 1: Details of the Population, Concept, Context (PCC) being investigated

The inclusion and exclusion criteria are shown in Table 2 and reference the PCC elements, which was standardized for title and abstract screening and full-text screening.

Inclusion	Exclusion
English Language	- Non-English language
Parkinson's, stage 1-4, Hoehn and Yahr	- Non Parkinson's
PWP with co-morbidities	
Partnered dance	- Non-partnered dance
	- Secondary studies
	- Did not mention effects of partner

Table 2: Inclusion and exclusion criteria of terms searched for the review

To be included in the review, papers needed to focus on Parkinson's (with participants included who have Parkinson's), partnered dance, and the effects of the partner in partnered dance. Participant criteria were kept broad in line with a ScR, thus, all Hoehn and Yahr stages of Parkinson's (Hoehn and Yahr, 1967) (a commonly used scale for describing symptoms of Parkinson's progressed) were included, as

were co-morbidities. Primary studies e.g. quantitative, qualitative, and mixed methods of studies were included. Secondary studies were excluded to avoid drawing secondary research data that had been included as primary papers. Only English language studies were included. No time constraint or geographical filter was added as over-refining may filter out any related studies. Papers were excluded if they did not fit into the PCC framework, e.g. only focusing on non-partnered dance, without mentioning any effects of partnered dance.

Information sources

An initial limited search of PubMed and CINAHL was undertaken on 16 November 2022 to identify articles on the topic (JBI, 2020). Titles, abstracts, and index terms were used to develop a comprehensive search strategy. The full search went on to include PubMed, CINAHL, COCHRANE Web of Science, EMBASE, and MEDLINE, Google Scholar, and Open Grey. Justification of the published database is listed in Appendix 1. Snowballing was performed, which is the process of screening the reference list of the included studies in case of missing preliminary studies (Kohli, 2020), and can have an additional yield of relevant studies up to 42.7% (Horsley, Dingwall and Sampson, 2011).

Search

The Boolean search strategy was applied (Aromataris and Rittano, 2014).

Truncations (*) and the “OR” operation were used to maximize the sensitivity (Leach *et al.*, 2022). The “AND” strategy was used to combine search terms to specify the search. Search terms were developed and executed by all the researchers and summarized in Appendix 2. A comprehensive search was carried

out of the seven databases mentioned above with the search terms from inception to March 2023. A picture of the entire search strategy from MEDLINE is shown in Appendix 3. After completing the database search, Mendeley software was used to remove duplications.

Selection of sources of evidence

Group members were divided into two groups to screen the titles and abstracts of 355 articles using the inclusion and exclusion criteria as shown in Table 2. Journals that were not relevant were excluded. Where the relevance of a study was unclear, the full text was obtained and reserved for retrieval.

Then the list of 59 studies for full-text screening was divided and distributed between the two groups to check their eligibility. Disagreements were resolved through whole-group discussion. Studies that did not meet the inclusion criteria were excluded. Included and excluded studies, with justifications, were presented in a PRISMA-ScR flow diagram (Figure 1).

Data Charting process

All five researchers determined which variables to extract and developed the tables. All the members charted the data, discussed the results, and continuously updated the tables in an iterative process. Article characteristics e.g. origins, aims, sample size, intervention type, intervention comparator, and effects of partner were extracted to the Data extraction table (Appendix 4).

Data Items

Data extracted included Parkinson's stage and medication, details of the intervention including setting, duration of the class, effects, cueing, type of partner, leading professionals, and outcome measures for the effects. Key themes and patterns that were identified were recorded in the Key Themes and Patterning charts (Appendices 5 and 6).

Finally, the Patterns, Advances, Gaps, Evidence for Practice and Research Recommendations (PAGER) framework was used (Appendix 7) to synthesise the results. Designed by Bradbury-Jones *et al.*, 2021, this tool provides an enhanced consistent approach to the analysing and reporting of review findings.

Critical appraisal

Critical appraisal of studies was not undertaken: unlike a systematic literature review (SLR), a ScR aims to scope the literature to summarize the current knowledge and gaps but not primarily focus on the quality of the studies.

RESULTS

Selection of sources of evidence

The PRISMA-ScR flow diagram (Figure 1) presents the article selection process. 763 articles were identified as potentially relevant to the research question. Titles and abstracts of 355 papers were screened against inclusion and exclusion criteria in Table 2. 59 articles were eligible for full-text review. The main reasons for exclusion were not referring to the effects of partners and having no access to full articles due

to time constraints to contact authors for full-text screening. Twelve articles were left for final synthesis.

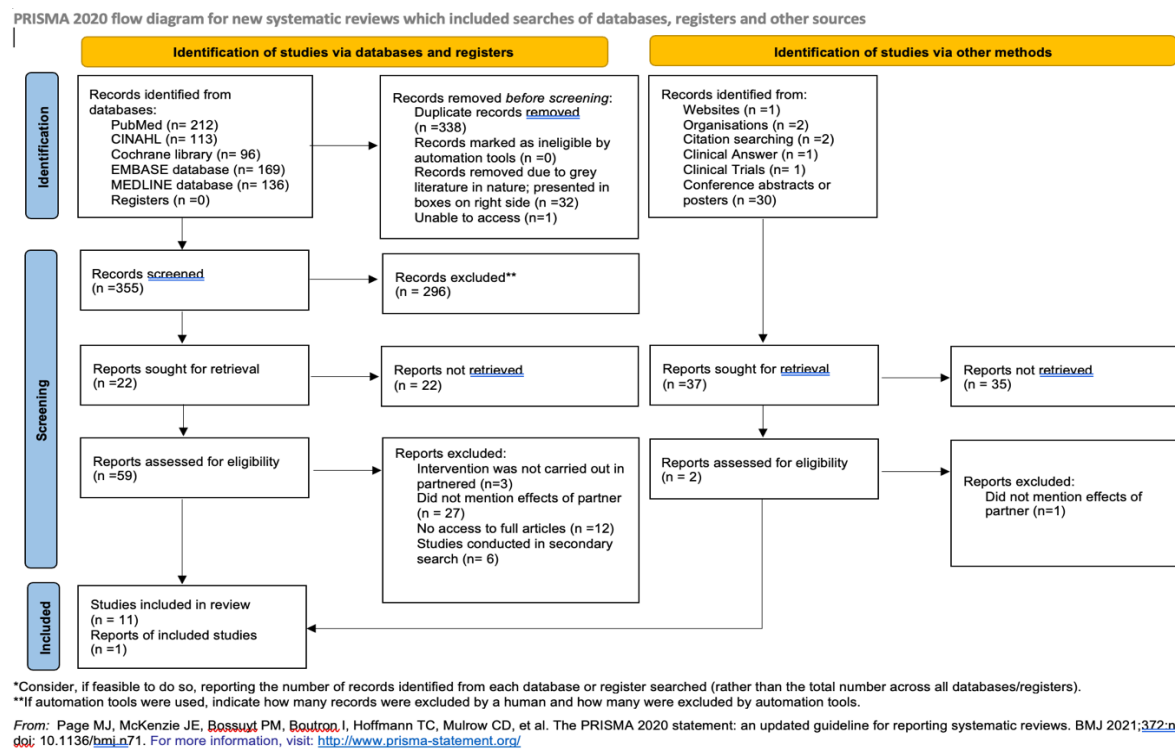


Figure 1: PRISMA-ScR flow diagram

Characteristics of sources of evidence

The articles' characteristics are described in Appendix 4, together with a description of the aim, origin, study design, sample size, intervention type, intervention comparator, and the effects of partners in partnered dance. The origins include the U.S.A., U.K., and Germany. The sample size varies from 11-102 participants. The duration of the class, effects of partnered dance, cueing, type of partner, leading professionals, medications, and outcome measures are listed in the Key themes charting (Appendix 5). The Parkinson's stage of participants in the papers ranges from stage one to four. The setting includes living communities, a local dance centre, a dance school, etc.

Results of individual sources of evidence

Four main themes from partnered dance were identified: (1) The partners' effects; (2) Types of partners; (3) Cueing (4) Leading professionals.

Effects of partner:

Physical

Nine out of twelve studies (Beerenbrock *et al.*, 2020; Giménez-Llort and Castillo-Mariqueo, 2020; Hackney *et al.*, 2020; Koch *et al.*, 2016; Duncan and Earhart 2012; Hackney and Earhart 2010; Marchant, Sylvester, and Earhart 2010; Hackney and Earhart, 2009; Hackney, Kantorovich and Earhart, 2007) mentioned the positive physical impacts. Two studies (Giménez-Llort and Castillo-Mariqueo, 2020; Hackney *et al.*, 2020) mentioned the effect of facilitating movement. Partners provide spatial external cues and timeframes to facilitate movements, coordination, and execution. The partner's weight-shifting and direction of movement help initiate movement, increase or maintain stride length and cadence, and improve weight-shifting techniques, strengthening the PWP's unity of movements. Five studies (Giménez-Llort and Castillo-Mariqueo, 2020; Marchant, Sylvester and Earhart, 2010; Hackney and Earhart, 2010; Hackney and Earhart, 2009; Hackney, Kantorovich and Earhart, 2007) stated improvements in balance and gait by external cues from partner e.g., physical contact at the hands, allows PWP to challenge their movement boundaries and use their partner's limbs to counterweight for self-balance. One study (Marchant, Sylvester, and Earhart, 2010) discusses the idea that the partner's help to develop weight-shifting provides an element of resistance that potentially enhances muscle strength.

Psychological

Six studies (Beerenbrock, *et al.*, 2020; Giménez-Llort and Castillo-Mariqueo, 2020; Kunkel *et al.*, 2018; Zafar, Bozzorg, and Hackney, 2017; Koch *et al.*, 2016; Kunkel *et al.*, 2017) mentioned psychological impacts. Dance partnerships impact the degree of the PWP's enjoyment and well-being. PWP found it more reassuring and pleasurable when dancing with a partner. The delightful atmosphere enhanced participation in dance class and extended social life. In the study by Koch *et al.* (2016), they used the outcome measure 'Therapeutic factors of art therapies in PD' and found that unison with the partner increased happiness after the intervention. Dancing with a partner radiates a sense of harmony among the family, as reported in a semi-standardized interview from the study by Beerenbrock *et al.* (2020). Negative psychological effects arose when opinions clashed and were unresolved, and the stress of perhaps "letting down partners".

Cueing

Nine studies (Giménez-Llort and Castillo-Mariqueo, 2020; Hackney *et al.*, 2020; Koch *et al.*, 2016; Kunkel *et al.*, 2017; Duncan and Earhart, 2012; Marchant, Sylvester and Earhart, 2010; Hackney and Earhart, 2010; Hackney and Earhart, 2009; Hackney, Kantorovich and Earhart, 2007) mentioned the cueing strategy. This includes auditory cueing e.g. music, verbal cueing, rhythmic and metronome, visual, tactile, cognitive, and cueing from partners which combines a mixture of the above types.

Types of partner

All the studies mentioned the types of partners, identifying six types: general volunteers, spouses, relatives, friends, caregivers and other participants in the intervention.

Leading professionals

Except for the studies by Giménez-Llort and Castillo-Mariqueo (2020) and Duncan and Earhart (2012), all included studies indicated different leading professionals: dance instructors, exercise trainers, therapists, and assistants.

Synthesis of results

Information of the effects, cueing, type of partner, leading professionals, medication and outcome measures for partnered dance were synthesized and patterned in the Patterning chart (Appendix 6).

DISCUSSION

This ScR identified twelve studies exploring the effects of partnered dance on PWP. Four key themes including the physical and psychological effects, the accompanying cues, the types of dance partners, and leading professionals will be discussed.

Many PWP experience freezing which impairs their ADLs (Tambasco *et al.*, 2016), and the inability to accomplish daily tasks leads to unsafe conditions and poor QoL (Edemekong *et al.*, 2022). Partners exert positive physical effects such as weight-shifting techniques and cueing direction of movement, to help initiate movement which may alleviate freezing partner supports the PWP to develop weight-shifting

techniques through turning. Different movements have various levels of weight transfer, for example: a step involves full weight-bearing, and a rock or check, only partial (Crewe, 2020). It is proven that multimodal biofeedback such as visual and vibrotactile together, delivered by the partner, facilitates movement initiation more effectively than just one modal (Lee *et al.*, 2015). However, one RCT (Hackney *et al.*, 2007) found that both the partnered Tango group and the exercise group showed trends toward reduction in freezing, with no difference between the two groups. Moreover, weight-shifting encourages greater use of the affected limb, enhancing muscle strength (Reyna, 2013). To overcome the offered resistance, the PWP utilizes isometric muscle control instead of “flopping” onto the partner (Binda, Culham, and Brouwer, 2010), possibly strengthening their muscles for daily use. Ideally, the improvement in initiating movements and muscle strength may prove to the PWP that they have the strength and promote participation.

Balance problems are related to fall risks, preventing PWP from being active due to fear of falling (Abendroth, Lutz and Young, 2012; Wielinski *et al.*, 2005). Partnered dancing intervention consistently improves balance performance (Shanahan *et al.*, 2015; Sharp and Hewitt, 2014; Earhart, 2010) and multiple types of sensory information have been indicated in two RCTs as critical elements of balance control for PWP (Lefavre and Almeida, 2015; Conradsson *et al.*, 2012). The results support the use of cueing from partners for improving balance, which correlates with the studies found in this review and the mechanisms will be explained under the theme “cueing”. Physical touch also allows the PWP to challenge their balance boundaries safely as they are confident that their partners will assist them by controlling dynamic balance and external disturbances, as well as providing readjustment of movement if

needed. The stops, starts, and turns with the partner can also be seen as a form of functional balance training (de Dreu *et al.*, 2012). Improvement in balance enhances motor learning, ADL performance, QoL, and well-being (Tan *et al.*, 2012; Ellis *et al.*, 2011).

Interestingly, partners were found to have positive and negative psychological impacts. Depression is prevalent in 8.1% of PWP (Changas *et al.*, 2013) and depressive symptoms correlate with decreased dopamine transporter in the anterior putamen (Weintraub *et al.*, 2005). Rhythmic tango steps have been shown to selectively activate the putamen by the PET scanner (Brown, Martinez and Parsons, 2006). It could be postulated that Tango improves depressive symptoms through activation of the putamen. Mood has been demonstrated to impact health, and the expression of emotion has certain health benefits (Goodill, 2005). It was found that dance partnership impacts the degree of enjoyment for PWP. They feel more reassured, and with the release of dopamine, the “happy hormone”, mood is improved and symptoms of anxiety and depression are alleviated (Douka *et al.*, 2019). As non-motor symptoms and motor symptoms are alleviated with dopamine release, participation in social activities increases, reinforcing the feeling of well-being. However, one interviewee who was the dance partner and spouse of the PWP from Kunkel *et al.* study (2018) stated that he felt stressed about leading due to the lack of confidence and difficulties and was afraid to let down his partner. Negative impact also happens when PWP and their partners have clashed opinions. Therefore, the choice of partner will be discussed.

Among the twelve studies, none of them discussed the cognitive effects of dancing with a partner yet 80% of PWP have one or more cognitive domains impaired after five years from diagnosis. Neuroimaging in PWP showed early affectation of monoamine and cortical systems beyond the nigrostriatal dopaminergic pathway that cause cognitive impairments with executive dysfunction, trouble concentrating, and memory issues (Speelman *et al.*, 2011). Available literature (Pereira *et al.*, 2019; Dhami, Moreno and DeSouza, 2015; Bläsing *et al.*, 2012) suggests that partnered dance contributes to a PWP's cognition improvement, including spatial memory, perception, and emotions, however, the benefits observed were not measured in a way that could directly attribute them to the presence of a partner. In other words, the benefits could be derived from other factors such as the steps or music. Research that attempts to explore this would allow a more holistic view of how partnered dance specifically affects cognitive function.

Cueing is defined as “an external temporal or spatial stimulant to facilitate movement initiation and continuation” (Lim, 2009). The caudate and putamen (collectively known as the striatum), are the input nuclei for the BG. The output nuclei SN and Globus pallidus (GP) inhibit the thalamus. External cues activate the cerebral cortex to send information to the striatum via the cortico-striatal pathway (Haber, 2016). The glutamate neurons in this pathway excite neurons in the striatum, releasing Gamma-aminobutyric acid (GABA) in the GP internal and substantia nigra pars reticulata (SNpr). The GABA inhibits activity in the GP and SNpr and stops inhibiting the thalamus that is involved in movements (Galvan *et al.*, 2010), thus opening the gate for movement to occur (Muthukrishnan *et al.*, 2019). The different types of cueing observed in the included studies were auditory, visual, tactile, cognitive, or combined

cues from the partner. With the aid of external cues, a PWP can achieve movements of nearly normal speed and amplitude through focused attention to critical aspects of movement (Baker, Rochester and Nieuwboer, 2007). Auditory cues improve the temporal parameters, including cadence and gait speed, which can bypass the internal rhythm deficit associated with Parkinson's (Lee, Lee and Song, 2015). Music is the most mentioned type of cueing and by affording a variety of mind-body responses from self-regulation to sensorimotor coupling, it is effective for mobility, psychological, social, and well-being (Bieńkiewicz and Craig, 2016). Nombela *et al.*, (2013) suggest that music also facilitates the activation of motor networks that bypass the Parkinson's-affected networks via cerebellum-thalamic-cortical circuitry. One study participant stated the music allowed her to forget her imbalance, lifted her the mood and found initiation of movement to be easier (Hackney, Kantorovich and Earhart, 2007). In contrast, some participants in the control group of the same study found it distracting which is corroborated by several Parkinson's studies that found music offered additional cognitive demands (Rose *et al.*, 2019). Previous studies have cited the importance of considering cultural aspects: PWP may find the class more enjoyable if they know the songs and become emotionally involved with specific memories of their culture (Jensen and Bonde, 2018; Hannon, Soley and Ullal, 2012).

Visual cues, such as stepping over and tapping a partner's foot, can relieve freezing of gait (Jiang and Norman, 2006) and enable the visual-cerebellar motor circuit that influences the spatial aspects of gait (Morris *et al.*, 1994). Tactile cues are presented in "contact improvisation" where the point of contact facilitates interaction through a shared site of stabilization or movement (Marchant, Sylvester and Earhart, 2010).

Contact improvisation techniques include “rolling and pulling” and also utilizing the negative space around the partner which may provide cognitive cues for creating movement (Marchant, Sylvester and Earhart, 2010). In the stroke population, a small sample size (n=22) study (Waller and Whitall, 2005) looking at bilateral arm training with rhythmic auditory cues (BATRAC), saw benefits in upper-extremity function and strength for people with left hemisphere lesions. Interestingly, and in opposition to these findings, a study by (Richards et al., 2007) found no effects, explained by the participants having a higher motor function, and being less sensitive to the treatment: this explanation is also supported by another study (Lum *et al.*, 2006), highlighting the importance of considering the individual’s severity level of condition when providing treatment. Controversially, cueing exerts negative effects on people with Huntington’s (PWH). One study found using musical and metronome cueing to be distracting for PWH while walking (Schaefer, 2014), contraindicating results for PWP where cueing assisted and improved PWP’s gait. This can be explained by a higher prevalence of attentional deficit and difficulties with sensori-motor synchronization in PWH as compared to PWP (Aldaaz *et al.*, 2019). This result implies some executive function and cognitive capacity is necessary for auditory cues to support gait (Schaefer, 2014), highlighting the importance to consider an individual’s cognitive level when using cues.

In the included studies a wide range of partners were recruited as shown in the Patterning chart (Appendix 5). However, only one interview study (Beerenbrock *et al.*, 2020) explored the impact of different partners on PWP. They suggest that when choosing volunteers, the experience should be considered, they should enjoy dancing, be sensible, and have good social skills, which is corroborated by a

recommendations paper by Hackney and Earhart (2010). Beerenbrock *et al.* (2020) suggest the PWP's experience of the dance class may be influenced by their relationship and compatibility with their partner: partners who were able to develop a good rapport gained greater enjoyment and a sense of achievement. Dancing with a spouse provides **morale** and emotional support to PWP, improving adherence and positive reinforcement. Participants who partnered with friends or relatives reported feeling motivated and more enjoyment as it was someone they knew. Participants who partnered with volunteers had ambiguous feelings, for example, if the PWP and the volunteer partner had a clash of personality or opinions, experience was less positive. One of the volunteers stated the dilemma of wanting to help without being seen to take over, which highlights the importance of the volunteer to encourage PWP to take the lead after safety considerations.

EVIDENCE GAP AND RECOMMENDATIONS FOR FUTURE STUDIES

PAGER (Appendix 7) was applied to analyze and report the inherent gaps, and how the review findings can resonate with and inform the future direction for both practice and research (Bradbury-Jones *et al.*, 2021).

This ScR has identified the physical and psychological effects of partnered dance on PWP in most of the included studies, however, none explored the cognitive effects. Researchers should investigate the effects of partnered dance on PWP cognitive function to consider whether partnered dance can be another adjunct treatment targeting cognitive symptoms in this population. Despite the use of outcome measures throughout the studies the direct physical and psychological effects of partnering on PWP were mainly self-reported by the participants or interpreted by the

authors. However, one study (Koch *et al.*, 2016) used The therapeutic factors of art therapies in PD outcome measure which directly measures the happiness with the company of the partner, and consists of eight items that reflect central hypothesized active factors in arts therapies related to the aesthetic experience particularly geared toward PWP. This highlights the need for designing unified outcome measures to ensure the validity of the findings and that they are specifically due to the presence of a partner rather than other factors. Evidence with regards to how the PWP's experience is affected by different types of partners is limited with the need for further exploration to validate the recommendations about the choice of the partner type.

Lastly, although the types of leading professionals recruited in the included studies were mentioned, none provide any evidence on how leading professionals impact on PWP in partnered dance, studies are required to address the significant gap in the field as a precursor for researchers to explore whether different types of leading professions exert different effects on PWP.

STRENGTHS AND LIMITATIONS

Recommended guidelines and standard methods were followed to conduct this ScR with a comprehensive literature search including grey literature. However, the following limitations should be considered when interpreting the review results. Firstly, to broaden the number of studies included, the stages of PWP in the Hoehn and Yahr scale, co-morbidity, and medications did not limit whether studies were included. This could affect sensitivity to interventions leading to varying results. Secondly, due to the scoping nature of this review, critical appraisal was not

conducted to rate the quality of evidence, therefore implications for practice cannot be graded. Lastly, due to time constraints, authors for studies that have no access to could not be contacted.

CONCLUSION

This ScR summarizes a collection of studies exploring different elements of partnered dance. It is important to consider symptom severity and cognitive levels when providing partnered dance treatment. With this in mind, two key benefits of partnered dance for PWP that are highlighted in this SR were found:

1. Physical: Mainly through initiation of movement and improving balance and gait
2. Psychologically: By providing reassurance, promoting socialization and enhancing participation and improving QoL.

A variety of cueing and the pathophysiology of cueing were discussed. Benefits of cueing are improved gait and initiation of movement, although some people may find cueing to be a distraction. This research also found that PWP's experience of dance classes may be influenced by their relationship and compatibility with their dance partners, so thoughtful recruitment of types of partners is needed. The paucity of articles discussing the effects of different leading professionals highlights the need for further investigations, e.g. systematic review for clinical implications when setting up partnered dance groups. Overall, this ScR provides a precursor for further investigations on different elements of partnered dance targeting different Parkinsonism symptoms.

(Word Count: 4721 words)

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APPENDICES

Database	Justification	Limitation
<p>PUBMED (cite: National Library of medicine, PubMed user guide.) https://pubmed.ncbi.nlm.nih.gov/help/#how-do-i-search-pubmed</p>	<ul style="list-style-type: none"> - Free resource - More than 34 million citations and abstracts of biomedical literature - Available to public online since 1996 - Maintained by the national center for biotechnology information (NCBI), at the U.S. National library of medicine (NLM) 	
<p>CINAHL</p>	<ul style="list-style-type: none"> - Covers more than 4500 journals from fields of nursing and allied health - Coverage dating as far back as 1937 - Offering complete coverage of English language nursing journals and publications from the national league for nursing and the American nurses' association, CINAHL covers nursing, biomedicine, health sciences librarianship, alternative/ complementary medicine, consumer health and 17 allied health disciplines (UWE, 2022) 	<p>Majority of the journals covered are in English language</p>
<p>AMED (Allied and complementary medicine)</p>	<ul style="list-style-type: none"> - Bibliographic database produced by the health care information service of the British library Cover 3 main subject areas: <ol style="list-style-type: none"> 1. Complementary medicine 2. Palliative care 3. Professions allied to medicine (physiotherapy, occupational therapy, rehabilitation, and speech & language therapy) <p>(UWE, 2022)</p>	
<p>COCHRANE LIBRARY</p>	<ul style="list-style-type: none"> - Considered to be the best only source of reliable evidence on the effects of health care - Includes the Cochrane database of systematic reviews (CDSR) which is leading resource for systematic reviews in health care <p>(UWE, 2022)</p>	
<p>EMBASE</p>	<ul style="list-style-type: none"> - Includes 24 million indexed recorded in the field of biomedicine - Covers more than 7500 current, mostly peer reviewed, journals, of 	

	<p>which 2000 are not included in Medline.</p> <ul style="list-style-type: none"> - Specialist areas include psychiatry and pharmacology - Includes conference abstracts from more than 7000 biomedical, drug and medical device conferences dating back to 2009 <p>(UWE, 2022)</p>	
MEDLINE	<ul style="list-style-type: none"> - Contains journal citations and abstracts for biomedical literature from around the world - US national library of medicine (NLM) premier bibliographic database and contains more than 26 million references to journal articles in life science with a concentration on biomedicine (UWE 2022) - Currently, citations from approximately 5200 worldwide journals in 40 languages; 60 languages for older journals. <p>(UWE, 2022)</p>	

Appendix 1: Justifications and limitations of databases

Search number	Search terms
Search 1	- 'Parkins*' or 'Parkinson's disease'
Search 2	- 'Partner danc*' or 'partnered dance*' or 'double danc*' or 'danc* with two people' or 'couple danc*' or 'Dance therapy' or 'Dance movement' or 'Dance movement therapy'
Search 3	'Tango' or 'Waltz' or 'Foxtrot' or 'Rumba' or 'Mexican danc*' or 'Latin danc*' or 'Cha Cha' or 'Swing' or 'Bolero' or 'Mambo' or 'Salsa' or 'Merengue' or 'Bachata' or 'Kizomba' or 'Lindy hop' or 'Balboa' or 'Charleston' or 'Shag' or 'Boogie woogie' or 'jitterbug'
Search 4	- Search 2 OR search 3
Search 5	- Search 1 AND search 2 AND search 4

Appendix 2: Search terms



Searching: MEDLINE [Choose Databases](#)

Suggest Subject Terms

<input type="text"/>	Select a Field (optional) ▾	<input type="button" value="Search"/> <input type="button" value="Clear"/> <input type="button" value="+"/> <input type="button" value="-"/>
AND ▾ <input type="text"/>	Select a Field (optional) ▾	
AND ▾ <input type="text"/>	Select a Field (optional) ▾	



[Basic Search](#) [Advanced Search](#) [PICO Search](#) [Search History](#) ▾

Search History/Alerts

[Print Search History](#) [Retrieve Searches](#) [Retrieve Alerts](#) [Save Searches / Alerts](#)

Select / deselect all

Search ID#	Search Terms	Search Options	Actions
<input type="checkbox"/> S5	S1 AND S2 AND S4	Search modes - Boolean/Phrase	View Results (136) View Details Edit
<input type="checkbox"/> S4	S2 OR S3	Search modes - Boolean/Phrase	View Results (66,349) View Details Edit
<input type="checkbox"/> S3	'Tango' or 'Waltz' or 'Foxtrot' or 'Rumba' or 'Mexican danc*' or 'Latin danc*' or 'Cha Cha' or 'Swing' or 'Bolero' or 'Mambo' or 'Salsa' or 'Merengue' or 'Bachata' or 'Kizomba' or 'Lindy hop' or 'Balboa' or 'Charleston' or 'Shag' or 'Boogie woogie' or 'jitterbug'	Search modes - Boolean/Phrase	View Results (65,186) View Details Edit
<input type="checkbox"/> S2	'Partner danc*' or 'partnered dance*' or 'double danc*' or 'danc*' with two people' or 'couple danc*' or 'Dance therapy' or 'Dance movement' or 'Dance movement therapy'	Search modes - Boolean/Phrase	View Results (1,275) View Details Edit
<input type="checkbox"/> S1	'Parkins*' or 'Parkinson's disease'	Search modes - Boolean/Phrase	View Results (164,006) View Details Edit

Refine Results

Current Search ▾

Boolean/Phrase:
S1 AND S2 AND S4

Limit To ▾

Linked Full Text

Search Results: 1 - 20 of 136 Relevance ▾ Page Options ▾ Share ▾

1. [Physical activity based on dance movements as complementary therapy for Parkinson's disease: Effects on movement, executive functions, depressive symptoms, and quality of life.](#)

(English) By: Duarte JDS; Alcantara WA; Brito JS; Barbosa LCS; Machado IPR; Furtado VKT; Santos-Lobato BLD; Pinto DS; Krejcová LV; Bahia CP. PLoS one [PLoS One], ISSN: 1932-6203, 2023 Feb 02; Vol. 18 (2), pp. e0281204; Publisher: Public Library of Science; PMID: 36730266;

Background: Parkinson's disease (PD) is a progressive, neurodegenerative disease with motor symptoms that are well understood, but non-motor symptoms may be present and appear at different temporal stages of the disease. Physical activity based on dance movements is emerging as a complementary therapeutic approach to a range of PD symptoms as a multidimensional activity that requires rhythmic synchronization and more neuromuscular functions.

Objective: To evaluate the effects of physical activity based on dance movements on the movement, executive functions, depressive symptoms, quality of life, and severity of PD in individuals diagnosed with PD.

Methods: 13 individuals with PD (Hoehn & Yahr I-III, MDS-UPDRS 67.62 ± 20.83), underwent physical activity based on dance movements (2x week for 6 months). Participants were assessed at baseline and after 6

Appendix 3: Figure of the entire search strategy from MEDLINE

1	Author (year)	Origin	Aims/ purpose	Study Design	Sample size	Intervention type	Intervention comparator	Effects of partnered dance
2	Hackney, M.E., Kantorovich, S. and Earhart, G.M. (2007)	USA	1) To determine whether the functional mobility benefits noted in elders following a tango dancing program might also extend to older individuals with Parkinson's 2) To provide baseline information about the effectiveness of a traditional strength/ flexibility exercise regimen based upon the Fit 'N Fun program 3) The long-term goals of this study are to establish how partnered expressive movement done to a rhythmic pulse, such as tango, influences functional mobility and to develop optimized therapeutic movement interventions to address balance and gait difficulties associated with PD and normal aging.	RCT	n=38	Argentine Tango	Traditional exercise	Provide helpful sensory information and stabilizing support that leads to improved balance and gait.
3	Zafar, M., Bozzorg, A. and Hackney, M.E. (2017)	N.A.	To determine (1) the impact of aging alone versus aging combined with disease on participation and (2) participation levels before and after a 12-week AT dance intervention in both older individuals with PD versus older individuals without PD.	Non randomised trial	n= 88	Adapted tango	Adapted Tango on older adults	Enhanced participation in social life
4	Kunkel, D. <i>et al.</i> (2017)	U.K.	To explore the feasibility of 1) using a Dance Centre to deliver a mixed dance program for people with Parkinson's, 2) exploring participant experience, 3) examining the appropriateness of our primary and secondary outcome measures, which will be incorporated into the planning of a larger phase III trial to address the efficacy question.	RCT	n=51	3 types of ballroom dance and 3 types of American Latin dance	Control-group participants were encouraged to continue with usual care, which typically comprised medication, attending medical clinics and routine visits from Parkinson's nurses	Reassuring
5	Marchant, D., Sylvester, J.L. and Earhart, G.M. (2010)	USA	To explore the feasibility, therapeutic potential and possible benefits of contact improvisation as an exercise intervention for individuals with PD	Pilot study	n=11	Contact improvisation(CI) dance	Tango dance	Developing weight shifting techniques. Learnt to use limbs as counterweight ballast- a means of self-balance. Weight shifting provided resistance both to the partner receiving and transferring weight, which has the potential to enhance muscle strength as a resistive exercise.
6	Hackney, M.E. and Earhart, G.M. (2010)	USA	To determine if individuals with PD would benefit more with respect to functional mobility if they participated in partnered or non-partnered tango lessons	RCT	n=39	Tango Dance	Non-partnered Tango Dance	Partners maintain physical connection, potentially aiding balance. More severely affected participants might be able to challenge their movement boundaries safely with the assistance of a partner.
7	Hackney, M.E. and Earhart, G.M. (2009)	USA	To compare the effects of two distinct 20-hour partnered dance programs to an untreated age-, sex- and stage of disease-matched cohort (Control)	RCT	n= 58	Tango and Waltz/Foxtrot dance	N.A.	Partnering provide important external cues. Partner may enhance balance by virtue of the physical contact at the hands. Cues such as the partner's weight shifting and indicated direction of movement can help initiate movement, and increase or maintain stride length and cadence.
8	Kunkel, D. <i>et al.</i> (2018)	U.K.	To explore the views and experiences of people with Parkinson's and their dance partners through in-depth, qualitative interviews to identify factors that may influence the benefits and enjoyment whilst participating in partnered ballroom and Latin American dance classes.	RCT	n=14	3 ballroom and 3 Latin American dance	N.A.	People with Parkinson's experience of dance classes were influenced by the relationship and compatibility with their dance partner. Dance partnerships impact on degree of enjoyment, outcome and continued participation in dance classes. Spouse partner provide "moral support" and shared enjoyment that this afforded Pwp. Pwp may have negative psychological effects if they have clash opinions and cannot resolve with their partners. They may also have views that afraid to let down their partners.

Appendix 4: Data extraction table (1)

1	Author (year)	Origin	Aims/ purpose	Study Design	Sample size	Intervention type	Intervention comparator	Effects of partnered dance
9	Giménez-Llort, L. and Castillo-Mariquero, L. (2020)	US	To propose PasoDoble as an intervention for people with Parkinson's and for their caregivers	Proposal	N.A.	PasoDoble (a type of ballroom dance)	Self-reliant older adults	<ol style="list-style-type: none"> 1) Dance partners may exert additive effects on achievement of rhythmicity since they both provide spatial external cues and timeframes that may facilitate movement initiation and execution in a PD-brain. 2) It is an effective and attractive form of entertaining for patients with PD due to the level of physical interactions and amusement between partners and the social group. 3) The dance partner can facilitate the coordination of the steps, increase balance and postural stability. 4) In turn, signals such as a change in weight and direction of movement given by the dance partner can help initiate the movement and increase or maintain the length and cadence of the steps. 5) The dance partner can help the mastery of balance and displacement by contributing to the control of dynamic balance, controlling external disturbances.
10	Beerenbrock, Y. et al. (2020)	Germany	To assess the perceived effects of Tango Argentino (TA) on body experience in individuals with PD.	Interviews	n=12	Tango Argentine	No direct comparator.	<ol style="list-style-type: none"> 1) Strengthening of unity in the movements during TA 2) Positive repercussions on one's own well-being 3) Sense of harmony radiated further into everyday life
11	Duncan, R.P. and Earhart, G.M. (2012)	U.S.	To determine the long term effects of a 12-month community based tango program for individuals with PD on disease severity and physical function, with all evaluations conducted off medication.	RCT	n=62	Argentine tango	N.A.	Progressive motor skills learning in the presence of external cues provided by the music and the partner.
12	Hackney, M.E. et al. (2020)	USA	Aim 1 will evaluate whether exercise reduces OFF-time in PD patients who regularly suffer OFF-time. Aim 2 will examine the effects of a combined motor/cognitive intervention on cognition, specifically spatial cognition. In Aim 3, with physiological biomarkers, we aim to show that exercise slows neurodegeneration in humans with PD. eople with Parkinson's	RCT	n=102	Partnered dance aerobic exercise	Walking aerobic exercise	<ol style="list-style-type: none"> 1) Partner can provide external cues to facilitate movement 2) Develop cognitive engagement from attention to partner and coordinating body movement with partner
13	Koch, S.C. et al. (2016)	Germany	<ol style="list-style-type: none"> 1) To assess the feasibility of measuring changes in psychological outcomes, specifically well-being, body self-efficacy, outcome expectations, and experienced beauty after a single Argentine Tango intervention in a workshop format. 2) To employ tango for PD patients to explore its impact on health-related psychological outcomes in the course of assessing the feasibility of a workshop format, and to explore the aesthetic experience as a therapeutic factor, an aspect previously unaddressed. 3) To show the feasibility of measuring health-related psychological changes following a single tango intervention, to ensure patient acceptance and that the workshop format is appropriate for patients with severe neurodegenerative health problems such as PD. 	Single-group pre-post design	n=34	Argentine Tango	N.A.	<ol style="list-style-type: none"> 1) Attuning to partner allows Pwp to repeatedly initiate movement without any problem 2) Music and partner affect and move the person in particular yet unpredictable and emergent ways that resonate within the lived body. The person's bodily resonance (kinesthetic) and the dance (kinetic) change and influence one another on a moment-to-moment basis 3) Pwp have pleasure of the company of their partner 4) The union with partner plays an additional role in that readjustment.

Appendix 4: Data extraction table (2)

1 2	Author	PD stage (Hoehn and Yahr Score)	Setting	Duration of class	Negative effects			Neutral			Positive effects			Cueing	Type of partner	Leading Professions	Medication	Outcome measures for partnered dance
					Physical	Psychological	Cognitive	Physical	Psychological	Cognitive	Physical	Psychological	Cognitive					
3	Hackney, M.E., Kantorovich, S. and Earhart, G.M. (2007)	1-3	N.A.	1 hour session, twice a week, 20 lessons within 13 weeks							✓			Music	Healthy Elderly from control group	A professional dance instructor/certified personal trainer.	On	N.A.
4	Zafar, M., Bozorg, A. and Hackney, M.E. (2017)	1-3	Senior independent living communities	90 mins session, 20 lessons within 12 weeks								✓		N.A.	Pwp: individuals without PD (caregivers, friends and relatives, graduate and undergraduate students). Older adults: younger volunteers and other participants in the class.	Tango instructors	On	N.A.
5	Kunkel, D. et al. (2017)	1-3	Local Dance Center	1 hour session, twice a week for 10 weeks.									✓	Verbal	Individuals nominated a potential dance partner, e.g. spouse, friend and family member. For those who did not have a partner, authors recruited healthy volunteers of similar age from the Dance Centre and local gym.	Professional dance teachers	N.A.	N.A.
6	Marchant, D., Sylvester, J.L. and Earhart, G.M. (2010)	2.4 ± 0.4	N.A.	1.5 hours session, 10 lessons over 2 weeks							✓		Rhythmic recurring, one-off, visual, tactile, auditory and cognitive	Healthy volunteers previously trained in contact improvisation	A professional improvisational dance instructor	On	N.A.	
7	Hackney, M.E. and Earhart, G.M. (2010)	1-4	N.A.	1 hour session, twice a week within 10 weeks							✓		Music and auditory.	individuals without PD (caregivers, loved ones and young adults volunteers recruited from physical therapy, pre-physical therapy and pre-medical programs).	An experienced professional ballroom dance instructor and an American Council on Exercise-certified personal trainer	On	N.A.	
8	Hackney, M.E. and Earhart, G.M. (2009)	1-3	N.A.	1 hour session, twice a week, within 13 weeks.							✓		Auditory cues from music, visual cues from partner	Healthy young volunteers recruited from physical therapy, pre-physical therapy and pre-medical programs.	An experienced professional ballroom dance instructor and an American Council on Exercise certified personal trainer	On	N.A.	
9	Kunkel, D. et al. (2018)	1-3	Local Dance Center	1 hour session, twice a week for 10 weeks		✓						✓	N.A.	Spouses, friends or relatives, and volunteer partners	Professional dance teachers	On	N.A.	

Appendix 5: Key themes charting (1)

10	Giménez-Llort, L. and Castillo-Mariqueo, L. (2020)	1-3	Socially established free-living environments (community setting such as elders social centers, home)	1 hour session, twice a week for 12 weeks							✓	✓		Visual, rhythmic auditory, metronome and music	Caregivers (Spouse most of the time or family)	N.A.	On	N.A.
11	Beerenbrock, Y. et al. (2020)	NA	The Tango Delepalata dance school in Dortmund and Lunen	1hour session for 10 weeks							✓	✓		N.A.	N.A.	Tango Argentine instructor	N.A.	N.A.
12	Duncan, R.P. and Earhart, G.M. (2012)	1-4	Community based Argentine Tango class	1 hour session, twice a week for 12 months							✓			Music	N.A.	N.A.	Off	N.A.
13	Hackney, M.E. et al. (2020)	1-3	N.A.	1.5 hour session, twice a week for 20 weeks 90-min weekly in maintenance period.							✓			Music and partner	Individual without PD, e.g. trained caregivers, friend, or university student.	Experienced instructor and trained assistant	On	N.A.
14	Koch, S.C. et al. (2016)	N.A.	SRH University Heidelberg and Ludwigshafen PD support group setting	1.5 hour session							✓	✓		Music, partner and group	Spouses, relatives/friends, or students of master program, or other patients	Dance movement therapists and tango teacher	N.A.	Scale for Therapeutic Factors of Arts Therapies in PD

Appendix 5: Key themes charting (2)

1	Author (Year)	Negative effects			Neutral			Positive effects			Cueing					Type of partner						Leading Professions				Medication		Outcome measures for partnered dance								
		Physical	Psychological	Cognitive	Physical	Psychological	Cognitive	Physical	Psychological	Cognitive	Auditory	Visual	Partner	Tactile	Cognitive	Volunteers	Spouse	Relatives	Friends	Caregivers	Other participants	Dance instructor	Exercise personal trainer	Therapists	Assistance	On	Off									
3	Hackney, M.E., Kantorovich, S. and Earhart, G.M. (2007)							✓													✓	✓														
4	Zafar, M., Bozzorg, A. and Hackney, M.E. (2017)								✓						✓		✓	✓		✓		✓														
5	Kunkel, D. et al. (2017)																																			
6	Marchant, D., Sylvester, J.L. and Earhart, G.M. (2010)							✓				✓	✓		✓	✓						✓													✓	
7	Hackney, M.E. and Earhart, G.M. (2010)							✓				✓			✓	✓					✓	✓													✓	
8	Hackney, M.E. and Earhart, G.M. (2009)							✓				✓	✓		✓	✓					✓	✓													✓	
9	Kunkel, D. et al. (2018)		✓													✓	✓	✓	✓			✓													✓	
10	Castillo-Marques, L. (2020)							✓	✓			✓	✓																						✓	
11	Breenbrock, Y. et al. (2020)							✓	✓													✓														
12	Duncan, R.P. and Earhart, G.M. (2012)							✓				✓																							✓	
13	Hackney, M.E. et al. (2020)							✓				✓			✓					✓	✓														✓	
14	Koch, S.C. et al. (2016)							✓	✓			✓			✓	✓	✓	✓			✓	✓				✓									✓	

Appendix 6: Patterning chart

Pattern	Advances	Gaps	Evidence for practice	Research recommendation
The partners' effect on PWP	There is evidence of positive effects from the partner to PWP physically and psychologically	1) There is a need for exploring unified outcome measures for measuring the effects of partners on PWP physically and psychologically. 2) There is limited evidence on the negative effects from the partner to PWP physically and psychologically. 3) There is lack of evidence on the effects from the partner to PWP cognitively.	1) When targeting to treat PWP physical symptoms, one may consider applying partnered dance. 2) Leading professionals should notice any psychological changes of PWP that may arise from their partners.	1) To develop an unified outcome measures to ensure the validity of the findings. 2) To carry out more research exploring any negative effects from the partner to PWP psychologically in partnered dance. 3) To carry out more research investigating any cognitive effects derived from partners.
Types of partner	There is an evidence that PWP's experience of the dance class appeared to be influenced by their relationship with their dance partners and their compatibility with them.	1) There is a need for ongoing empirical work exploring how different types of partners affect PWP. 2) There is inadequate of research about any different physical effects derived from different partners on PWP.	1) It is important that professionals or research conductors consider the recruitment or selection of the types of partners when conducting partnered dance class for PWP and to consider any training need to be given to PWP's partners.	1) To continue exploring the relationship between different types of partners and the effects on PWP to validate recommendations on the choice of the type of partners. 2) To carry out more research exploring any possible/ different physical effects derived from various types of partners.
Cueing	There is evidence of a positive relationship between different types of cueing and the effects on PWP.	1) There is a lack of studies unifying the use of types of cueing targeting various symptoms for PWP. 2) There is a paucity of research on the direct effect of cueing on PWP in partnered dance.	1) It is important that professionals or research conductors consider what and how different types of cueing can be applied to assist and benefits PWP.	1) Research is needed to specifically investigate how different types of cueing can affect PWP differently, particularly in partnered dance.
Leading professionals		1) There is a paucity of evidence of how different leading professionals may affect PWP's participation to class, physically, psychologically and cognitively.	1) Evidence to emerge from future research	1) Studies are required to address the significant gap in the field regarding leading professionals' impact on PWP.

Appendix 7: Patterns, Advances, Gaps, Evidence for Practice and Research Recommendations (PAGER) framework