Dancing and Parkinson’s disease: updates on this creative approach to therapy

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Introduction: Parkinson’s disease (PD) is associated with slowness of movement and balance disturbance. Anxiety and social isolation are common and quality of life (QoL) can be compromised. Dancing enables people with PD to participate in an enjoyable form of exercise within a group. This review provides an updated synthesis of the literature comparing dance to other interventions in people with PD.

Methods: Six databases were electronically searched. Relevant articles were identified using inclusion criteria. Data on participants, the dance intervention, and outcomes were extracted from suitable articles.

Results: Methodological limitations were evident in 13 included articles. The evidence reviewed suggests that dancing is enjoyable and can improve balance, motor function, and QoL. Further research is needed to determine the effect of dancing on cognition and depression in this population. Longer term dance interventions may be needed to achieve more meaningful benefits in mobility.

Conclusion: Dancing can be a feasible and beneficial physical activity and improve the well-being of individuals with PD.

Keywords: Parkinson’s disease, dance, physical activity

Introduction
Parkinson’s disease (PD) is common, affecting at least 7 million people worldwide.1 With disease progression, people can experience movement difficulties2 and problems participating in social1 and family life3 and physical activities.3 Movement disorders associated with PD together with insufficient exercise can compromise balance and gait, contributing to further inactivity,4 falls,5 isolation, and loss of independence.6 Although the benefits of exercise are well-recognized for people with PD,9,10 sedentary lifestyles remain common and can be debilitating.11

Therapeutic dancing has become popular for people with Parkinson’s.12,13 It is purported to offer an enjoyable and social setting for physical activity in addition to boosting exercise motivation,14,15 social interaction, and emotional well-being. Previous reviews have shown that some forms of dance can improve balance,16 motor function,17 and quality of life (QoL)12 in people with mild to moderately severe PD. More recently, a resurgence of new studies has been published and offers new insight into the benefits of dance for people with PD. There is a need to provide an updated synthesis of the multidimensional benefits of dance for people with PD compared to other interventions or a control. This may enable evidence based practice and help
clinicians and/or dance therapists to justify their treatment
decisions and offer the most beneficial therapies to patients.

The aim of this systematic review is to provide an updated
1) synthesis and critique of the literature on dance for people
with PD and 2) review of the physical and non-motor benefits
dance for people with PD compared to other interventions
and/or control groups.

Methods
The methods of this review conform with the Preferred
Reporting Items for Systematic Reviews and Meta-Analyses
(PRISMA) statement.18

Inclusion criteria
Peer-reviewed published articles were included if they evalu-
ated the benefit of a dance program for people with PD. There
was no restriction on the stage of PD, described using the
Hoehn and Yahr or modified Hoehn and Yahr scale. Studies
must have been written in English, included more than one
participant, and reported at least one of the outcomes of
interest using a quantitative approach. Only study designs
involving two or more arms were eligible for inclusion.
Review articles and qualitative studies were not included
in this review.

Literature search
EBSCO was used to electronically search Academic Search
ScienceDirect and Pubmed Central were also searched. Data-
bases were searched by title/abstract. The search terms used
were “Parkinson OR Parkinson’s” AND “dance OR danc-
ing OR dancers”. One reviewer (JS) screened the retrieved
articles by title/abstract and those unrelated were excluded.
The remaining full-text articles were read and two reviewers
determined their suitability for inclusion (JS and AMC). Any
discrepancies between the reviewers were resolved through
discussion. An overview of the search process is shown in
Figure 1.

Data extraction
The following data were extracted from eligible articles:
• Characteristics of participants (number of participants,
age, stage of disease).
• Characteristics of the intervention (dosage, therapy
offered, attendance, satisfaction, adverse events,
dropouts).
• Outcomes of interest.

• Results: the results of both intragroup (the difference
between pre- and post-assessment results within each
study group) and intergroup comparisons (the difference
between the study groups after the intervention) were
extracted. In line with the aim of this review, data on both
types of comparisons were included in order to 1) identify
the aspects of health improved by dance participation and
2) ascertain if dancing may be equally or more beneficial
than other therapies or a control.
• Methodological features.

Outcomes of interest
The lives of people with PD are often negatively affected by
physical and non-motor symptoms associated with the condi-
tion. Therefore, the outcomes of interest and measurement
tools listed in Table 1 were chosen for this review.

Only data from one measurement tool were extracted
per outcome. If an outcome was assessed using two or more
tools, data from the measurement tool of interest (Table 1)
were prioritized. Outcomes of interest assessed using tools
not mentioned in Table 1 were considered for review. If an
outcome was assessed with two or more tools not detailed
in Table 1, data regarding the first tool listed in the study
were extracted.

Quality assessment
The design of each study was defined using the Cochrane
Handbook of Systematic Reviews of Interventions.28 The
quality of randomized controlled trials (RCTs), quasi-
RCTs, stratified RCTs, and non-RCTs was appraised using
the PEDro scale.29,30 This scale has been used in previous
systematic reviews.9,12 The quality of controlled before and
after studies and case-controlled studies was critiqued using a
checklist developed by Lötzke et al.13 This tool provides a list
of criteria for evaluating the quality of various study designs
and has been used in previous reviews of dance interventions
for people with PD.13

Data synthesis
The information extracted from the included articles was
synthesized qualitatively. Due to the high level of clinical
heterogeneity in the studies, quantitative analysis was not
recommended.

Results
The search strategy retrieved 305 articles and 13 were eligible
for inclusion (Figure 1). The included articles consisted of
one quasi-RCT,31 one case-controlled study,32 one controlled
Dancing for Parkinson’s disease: an update

before and after study,33 two non-RCTs,34,35 one stratified RCT,36 and seven RCTs.37–43

Table 2 displays the characteristics of the included studies. The collective sample size across the studies was 533 participants and the average age of participants ranged from 57.90 to 72.6 years.35,40 There were 138 dropouts across all studies. Some of the reasons for dropping out of dance classes included fatigue,39 changes in health status,39,41–43 fractures,31 knee pain,37,38 leg injury outside of class,32 family reasons,32,38,42 desire not to continue,39,41 and travel or schedule difficulties.38,39,41,42 Two studies did not state the reasons for dropout and the number of dropouts per group.34,35 Over 50% of studies failed to state if they monitored for adverse events.
<table>
<thead>
<tr>
<th>Study (study design)</th>
<th>Intervention strategy</th>
<th>Dropouts (N)</th>
<th>Stage of disease (H and Y ranges)</th>
<th>Adverse events monitoring</th>
<th>Adherence</th>
<th>Intervention satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>de Natale et al(^*) (NRCT)</td>
<td>Tango: N=9, 66 years Traditional therapy: N=7, 70 years</td>
<td>N=2 (unclear which group)</td>
<td>Range = ND Tango: 2.5 Traditional rehabilitation: 2.6 (mean)</td>
<td>None</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Duncan and Earhart(^*) (RCT)</td>
<td>Tango: N=32, 69.3 years Control (no intervention): N=30, 69 years</td>
<td>Tango group =16 Control group =11</td>
<td>1–4</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Hashimoto et al(^*) (quasi-RCT)</td>
<td>Dance (fusion of dance genres): N=19, 67.9 years Exercise: N=21, 62.7 years Control (no intervention): N=19, 69.7 years</td>
<td>Dance =4 Exercise =4 Control =3</td>
<td>2–4</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Hackney and Earhart(^*) (RCT)</td>
<td>Partnered tango: N=19, 69.6 years Non-partnered tango: N=20, 69.6 years</td>
<td>Partnered tango =7 Non-partnered tango =5</td>
<td>1–3</td>
<td>N/A</td>
<td>N/A</td>
<td>Partner group: greater enjoyment and desire to continue</td>
</tr>
<tr>
<td>Hackney and Earhart(^*) (RCT)</td>
<td>Tango: N=19, 68.2 years Waltz/foxtrot: N=19, 66.8 years Tai chi: N=17, 64.9 years Control (no intervention): N=20, 66.5 years</td>
<td>Tango =5 Waltz/foxtrot =2 Tai chi =4 Control =3</td>
<td>1–3</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Hackney and Earhart(^*) (RCT)</td>
<td>Tango: N=19, 68.2 years Waltz/foxtrot: N=19, 66.8 years Control (no intervention): N=20, 66.5 years</td>
<td>Tango =5 Waltz/foxtrot =2 Control =3</td>
<td>1–3</td>
<td>N/A</td>
<td>80% attended 100% of dance sessions</td>
<td>No difference between enjoyment and desire to continue in tango and waltz/foxtrot</td>
</tr>
<tr>
<td>Hackney et al(^*) (RCT)</td>
<td>Tango: N=9, 72.6 years Exercise: N=10, 69.6 years</td>
<td>None</td>
<td>2–3 (modified)</td>
<td>N/A</td>
<td>100% all participants</td>
<td>Tango: N=4 attended additional sessions Exercise: N=0 attended additional classes</td>
</tr>
<tr>
<td>Lukšys and Griškevičius(^*) (NRCT)</td>
<td>Lindy hop dance: N=14, 65.43 years Control (no therapy): N=10, 57.9 years</td>
<td>N=1 (unclear which group)</td>
<td>Range: ND Lindy hop dance: 2 Control: 2.1 (mean)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>McNeely et al(^*) (case-controlled study)</td>
<td>Dance for PD: N=1 Dance for PD =3 Tango: N=8, 67.66 years</td>
<td>Dance for PD =3 Tango (matched participants)</td>
<td>1–3 (modified)</td>
<td>N/A</td>
<td>7.46 participants per class (average)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

(Continued)
The benefit of seven dance genres was investigated. Two studies compared dance with traditional therapy approaches, three compared dance to Tai Chi, three studies compared different forms of dance, three other studies compared dance to exercise, and six studies compared dance with no intervention. Participants in the traditional therapy and exercise interventions performed exercises to improve strength, flexibility, range of motion, mobility, balance, and motor coordination. Cueing was also used in two studies as part of the intervention. The dance interventions were well-described in 10 studies. Seven studies stated that a warm-up was performed at the start of class and nine studies used dance instructors with previous experience.

The volume of dance activity in each study and the results of intragroup (the difference between pre- and post-assessment results within each study group) and intergroup comparisons (the difference between the study groups after the intervention) are summarized in Tables 3 and 4. Where possible, the results of intragroup comparisons were presented quantitatively. If the required raw data were not provided in the original article, the results were described qualitatively.

The results of the quality appraisal for RCT and non-RCTs are presented in Table 5. No study fulfilled the criteria for blind therapists and subjects. Five studies scored 7/10 indicating good methodological quality. One study scored 2/10 indicating major methodological flaws. The case-controlled trial and controlled before and after study fulfilled the majority of criteria in the checklist as shown in Table 6.

**Discussion**

The results of this review inform clinicians and dance therapists about the potential benefits of dancing compared to other therapies and will help therapists to treat and advice patients considering dancing as an exercise hobby.

Promoting well-being and physical activity are key priorities for clinicians treating individuals with PD. Nevertheless, physical inactivity remains common and may negatively impact mood, balance, and gait. The evidence in this review indicates that dancing is enjoyable and can motivate regular participation. The group setting of dance along with the various styles and music may create positive emotional responses and encourage weekly participation. Whether or not people with PD will continue dancing over prolonged periods of time requires further research.
Table 3  Intervention design and results of intragroup comparisons

<table>
<thead>
<tr>
<th>Study</th>
<th>Volume of dance therapy</th>
<th>Groups</th>
<th>Balance</th>
<th>Mobility</th>
<th>Motor function</th>
<th>Depression</th>
<th>Cognition</th>
<th>QoL</th>
<th>Fatigue</th>
</tr>
</thead>
<tbody>
<tr>
<td>de Natale et al43</td>
<td>20 h in 10 w</td>
<td>Tango</td>
<td>+2.13</td>
<td>-2.69*</td>
<td>+0.25</td>
<td>N/A</td>
<td>+1.38</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traditional rehabilitation</td>
<td>+2</td>
<td>+0.2</td>
<td>+2.33</td>
<td>FAB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BBS</td>
<td>TUG</td>
<td></td>
<td>UPDRS-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duncan and Earhart41</td>
<td>2 h/w ×12 months</td>
<td>Tango</td>
<td>Improved*</td>
<td>+12.8*</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td></td>
<td>+3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hashimoto et al41</td>
<td>12 h in 12 w</td>
<td>Fusion dance</td>
<td>+4*</td>
<td>+1.9*</td>
<td>+6.6*</td>
<td>N/A</td>
<td>+3.1*</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exercise</td>
<td>+0.2</td>
<td>+0.9*</td>
<td>+25</td>
<td>+1*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>0</td>
<td>+0.9*</td>
<td>N/A</td>
<td>FAB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hackney and Earhart39</td>
<td>20 h in 10 w</td>
<td>Partnered tango</td>
<td>+3.2*</td>
<td>+0.4</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-partnered tango</td>
<td>-0.1</td>
<td></td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hackney and Earhart37</td>
<td>20 h within 13 w</td>
<td>Tango</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td></td>
<td></td>
<td>Waltz/fox trot</td>
<td></td>
<td></td>
<td>N/A</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>Tai chi</td>
<td></td>
<td></td>
<td>N/A</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Control</td>
<td>0</td>
<td></td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hackney and Earhart39</td>
<td>20 h within 13 w</td>
<td>Tango</td>
<td>+3.9*</td>
<td>+4*</td>
<td>+1.6</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ballroom</td>
<td>+4*</td>
<td>-0.2</td>
<td>+2.6</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>-1.2</td>
<td></td>
<td>-5*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hackney et al40</td>
<td>20 h within 13 w</td>
<td>Tango</td>
<td>+3.8*</td>
<td>+0.9</td>
<td>+8*</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exercise</td>
<td>+1.7</td>
<td>-0.1</td>
<td>+7.6*</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lukšys and Griskiuvicius25</td>
<td>22 h in 2 months</td>
<td>Lindy hop dance</td>
<td>N/A</td>
<td>N/A</td>
<td>+5.15</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td></td>
<td></td>
<td>-12.44</td>
<td>UPDRS-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McNeely et al32</td>
<td>24 h in 12 w</td>
<td>Dance for PD</td>
<td>+0.5*</td>
<td>-0.51</td>
<td>+1.62</td>
<td>N/A</td>
<td>N/A</td>
<td>-4.58</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tango</td>
<td>+1.25*</td>
<td>+0.97</td>
<td>+9.38</td>
<td>N/A</td>
<td></td>
<td></td>
<td>N/A</td>
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<tr>
<td></td>
<td></td>
<td>Mini-BESTest</td>
<td>TUG</td>
<td></td>
<td>MDS-UPDRS-3</td>
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</tr>
<tr>
<td>Rios-Romenets et al43</td>
<td>24 h in 12 w</td>
<td>Tango</td>
<td>+0.7</td>
<td>+1.3*</td>
<td>+1.6</td>
<td>+0.4</td>
<td>+0.4</td>
<td>+0.4</td>
<td>+3.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Self-directed exercise</td>
<td>-0.7</td>
<td>-0.1</td>
<td>+1.2</td>
<td>-0.6</td>
<td>+1.3</td>
<td></td>
<td>-2.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>control</td>
<td>Mini-BESTest</td>
<td>TUG</td>
<td>MDS-UPDRS-3</td>
<td>BDI</td>
<td>MoCA</td>
<td></td>
<td>PDQ-39</td>
</tr>
<tr>
<td>Shanahan et al42</td>
<td>25 h in 10 w (15 h class plus 10 h HEP)</td>
<td>Irish set dance</td>
<td>No change in either group</td>
<td>N/A</td>
<td>Minimal improvement</td>
<td>N/A</td>
<td>N/A</td>
<td>Dance improved more than control</td>
<td>PDQ-39</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>Mini-BESTest</td>
<td>TUG</td>
<td>MDS-UPDRS-3</td>
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(Continued)
Physical benefits

The results of this review suggest that dancing can improve balance and motor function. With respect to balance, all studies except one reported improvements following the intervention. In the majority of studies, gains >2.84 points were evident on the Berg balance scale. Previous research suggests that this magnitude of improvement could be functionally significant for people with PD and make the completion of everyday tasks easier. Clinically meaningful changes seem more difficult to achieve on the mini-BESTest, particularly in the short term. This suggests that some dance programs may not effectively target all the aspects of postural control assessed in the mini-BESTest.

Future studies should carefully plan the content of the intervention and ensure that the material safely challenges all aspects of balance control.

The dosage of dance may influence balance performance. The longest duration interventions noted the largest improvements in balance. This is consistent with the American College of Sports Medicine exercise recommendations which advise long-term exercise participation to optimize health benefits. An insufficient dosage of dance, due to low compliance with the home program, may explain the lack of balance improvement found by Shanahan et al.

From the
evidence reviewed, it is obvious that ~20 hours of dancing within 10–13 weeks may be needed to improve balance.

There is preliminary evidence to suggest that dance can improve motor function. Dance participants achieved gains that surpassed the minimal clinically important difference for the unified PD rating scale motor section and Movement Disorders Society unified PD rating scale motor section in six studies (Table 3). Compared to nondance interventions, dancers achieved better motor performance following the intervention and the difference between groups was statistically significant in two studies. There is insufficient evidence to indicate that some dance forms are more effective than others for improving motor function; however, further research is warranted. This would identify dance genres that preferentially target certain symptoms and help individualize the referral process to classes.

Although evidence suggests that dance can improve mobility, the results reported in studies demonstrated lower than the minimal detectable change for the timed up and go test for people with PD. Previous research on physiotherapy interventions in this population reported similar results. In the current review, the duration of the interventions may explain the lack of substantial improvement in mobility. Many of the included studies involved short durations and the progressive nature of PD could make it harder to achieve mobility gains within this time frame. At present, there is a paucity of evidence examining the long-term benefit of dance on mobility in people with PD and future studies are needed. Notably, the dance interventions were sufficient to maintain mobility and this was significantly better than comparison therapies in some studies. Qualitative research studies are warranted to ascertain the perceived benefits of dancing and determine if dancing positively impacts the everyday lives of people with PD.

Non-motor benefits

At present, there is insufficient evidence to suggest that dance can improve cognitive performance and depression in people with PD. Only one study reported significant cognitive and mood improvements following dance participation. The improvements noted in other studies that assessed these outcomes were small and may be clinically insufficient. Notably, no study in this review reported negative mood or cognitive effects of dancing. In individuals without PD, research has found that participation in partnered dance styles is associated with perceived cognitive, social, and emotional health benefits. The combination of motor skill learning,
exercise, socialization, and music is hypothesized to improve mood and cognition\(^\text{14}\) and further research is recommended in people with PD.

Fatigue affects over 50% of people with PD and is perceived to be one of the most debilitating symptoms of this condition.\(^\text{56}\) Music accompaniment in dance may help combat fatigue by activating brain areas such as the amygdala and cingulate cortex and stimulating dopamine.\(^\text{48}\) Only one included study examined the impact of dance on fatigue.\(^\text{43}\) While the results of this study were positive, more research is warranted to determine if dancing can help people with PD manage this debilitating symptom.

In comparison with nondance groups, QoL improved more in dance participants. Although one study reported contrary results, the clinical meaningfulness of this finding is unclear.\(^\text{43}\) Further research will help ascertain the optimum styles of dance to improve QoL.

In conclusion, it is important that studies consider the effect of environmental factors on health and participation outcomes and implement strategies to overcome any challenges encountered.

**Limitations**

The limitations of this review must be considered when interpreting the results. Many of the included studies were small. This limits the clinical transferability of the results. Four studies were non-randomized and therefore have an increased risk of bias.\(^\text{32–35}\) The majority of RCTs and non-randomized studies have an increased risk of selection bias.\(^\text{34,35,37–41,43}\) Comparability between the groups at baseline was also lacking in four studies.\(^\text{31,35,37,43}\) Reporting and monitoring of social and learning environment and are led by a patient teacher who has the skills necessary to adapt dances for each individual.\(^\text{57,58}\) Importantly, these factors may influence the joy experienced at dance classes and subsequently affect QoL. A sense of satisfaction and perceived benefit in QoL may be important to enhance continual participation,\(^\text{59}\) create positive attitudes toward exercise, and improve well-being. The social context of dance may be particularly pertinent to build social networks, friendships, and social connectedness;\(^\text{3}\) however, this needs to be assessed in future studies.

### Table 6 Methodological quality of controlled before and after and case-controlled studies

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Ventura et al(^\text{33})</th>
<th>McNeely et al(^\text{32})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication specific aspects</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Objective/aim of the study reported</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Description of the study design</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Hypothesis reported</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Adequate description of the subject assembly process, characteristics of participants</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Description of determination of the study participants/number of participants justified</td>
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<td>Y</td>
</tr>
<tr>
<td>Method of patient selection described</td>
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<td>N</td>
</tr>
<tr>
<td>Description of inclusion criteria</td>
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<td>Y</td>
</tr>
<tr>
<td>Description of exclusion criteria</td>
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<td>N</td>
</tr>
<tr>
<td>Eligible but not enrolled subjects and reason for exclusion</td>
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<td>Y</td>
</tr>
<tr>
<td>Number of participants enrolled in study</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>If controlled design is reported, how the participants were assigned to the groups</td>
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<td>N/A</td>
</tr>
<tr>
<td>If RCT, randomization method explained</td>
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<td>N/A</td>
</tr>
<tr>
<td>Baseline data for each group</td>
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<td>Y</td>
</tr>
<tr>
<td>Baseline data reported</td>
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<td>Y</td>
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<tr>
<td>Age reported</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Proportion of female/male reported</td>
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<td>Y</td>
</tr>
<tr>
<td>Equality of comparison group in the case of controlled studies discussed</td>
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</tr>
<tr>
<td>Adequate description of subject follow-up</td>
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</tr>
<tr>
<td>Dropout rates reported</td>
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</tr>
<tr>
<td>Explanation for dropouts</td>
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<tr>
<td>Adequate description of treatment</td>
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<td>Y</td>
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<tr>
<td>Description of treatment</td>
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<tr>
<td>Intervention period reported</td>
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<tr>
<td>Discussion of limitations</td>
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</tbody>
</table>

**Abbreviations:** Y, yes; N, no; N/A, not applicable.
adverse events were insufficient in the literature (Table 3). This presents a challenge when clinicians need to establish the suitability of dance interventions for people with PD. Future research should consider these limitations and design study protocols that limit their occurrence.

There were a number of dropouts in the included studies. Collectively, the dropout rate was nearly 26%. This is higher than that reported in some other interventions60 and makes it difficult for clinicians to determine the feasibility of dance therapy. The reason for the higher dropout rate reported in this review is unclear. However, many of the reasons for dropping out are modifiable and need to be considered in future studies. Additionally, many people have experiences of dance47 and it is plausible that the dancing organized as part of research afforded different experiences and discouraged participation. Dance is not just an exercise. It is a form of artistic expression that captures social and emotional experiences.36 Collaboration between people with PD and arts and health therapists may help identify the desired elements of dance classes and improve the retention rates in studies.

Conclusion
Dancing can be a valuable and enjoyable activity for people with PD. Dance may benefit balance, motor function, and QoL compared to some other forms of therapy. Further research is needed to examine if dancing can improve mobility and non-motor symptoms in people with PD.

Disclosure
This manuscript entitled “Dancing and Parkinson’s disease: updates on this creative approach to therapy” has not been published previously and is not under consideration by another journal. The authors report no conflicts of interest in this work.

References


