

- 1 **Adherence to the Class-Based Component of a Tai Chi Exercise Intervention for**
- 2 **People Living with Dementia and Their Informal Carers**
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Barrado-Martín, Y., Heward, M., Polman, R., & Nyman S. R. (in press). Adherence to the class-based component of a Tai Chi exercise intervention for people living with dementia and their informal carers. *Journal of Aging and Physical Activity*.

## 1 **Abstract**

2 Objective: The aim of this study was to understand the experiences of people living  
3 with dementia and their informal carers' taking part together (in dyads) in Tai Chi  
4 classes and the aspects influencing their adherence.

5 Methods: Dyads' experiences of taking part in Tai Chi classes for 20 weeks within the  
6 TACIT Trial were explored through class observations (n = 22 dyads), home-interviews  
7 (n = 15 dyads) and feedback. Data was inductively coded following thematic analysis.

8 Results: Tai Chi classes designed for people with dementia and their informal carers  
9 were enjoyable and its movements, easy to learn. Facilitators of their adherence were  
10 the socializing component and their enjoyment of the classes, whereas unexpected  
11 health problems were the main barrier.

12 Discussion: Finding the optimal level of challenge in the class setting might be crucial  
13 for people with dementia to feel satisfied about their progression over sessions and  
14 enable their continued participation.

## 15 **Keywords**

16 Falls; Barriers; Facilitators; Qualitative research; Self-determination theory.

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3

## 4 **Introduction**

5 Dementia is estimated to affect 50 million people around the globe with prospects  
6 pointing towards 131.5 million people living with dementia by 2050 (Alzheimer's  
7 Disease International, 2015). Its prevalence, the impact on the person with the  
8 diagnosis, their relatives, the strains on the social and healthcare systems, and the lack  
9 of a cure have made dementia a public health priority (Department of Health, 2015;  
10 WHO, 2018). Similarly, falls have also been identified as a global problem among older  
11 people due to its higher prevalence in this population and associated risk of mortality  
12 (WHO, 2007). Among older adults, people living with dementia are more likely to  
13 experience falls than their peers as well as experience more severe consequences after a  
14 fall, including increased dependence and death (Allan, Ballard, Rowan, & Kenny, 2009;  
15 Fernando, Fraser, Hendriksen, Kim, & Muir-Hunter, 2017; Shaw, 2003). Hence, the  
16 development of interventions to prevent falls and people living with dementia's  
17 adherence to these is key to improving their own and their carers' quality of life.

18 Exercise is an effective intervention to prevent falls, particularly those exercises  
19 challenging balance, such as Tai Chi (Nyman, 2020; Sherrington et al., 2019). However,  
20 adherence to exercise and falls prevention interventions has been reported as a  
21 limitation for older people living with dementia to get the benefits of these interventions  
22 (Burton et al., 2015). Previous research has highlighted characteristics of the exercise  
23 intervention that would facilitate people living with dementia's adherence to exercise  
24 classes (i.e., including a socializing component, tailoring exercise to individual needs,  
25 and memory aids such as attendance reminders) (Dal Bello-Haas, O'Connell, Morgan,  
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1 & Crossley, 2014; Frederiksen, Sobol, Beyer, Hasselbalch, & Waldemar, 2014; Pitkälä  
2 et al., 2013), of the instructor (i.e., charisma and expertise) (Dal Bello-Haas et al.,  
3 2014; Frederiksen et al., 2014; Pitkälä et al., 2013; Prick, de Lange, van 't Leven, &  
4 Pot, 2014), and participants (i.e., ability to sustain attention, expectations, perceived  
5 benefits and motivations) (Dal Bello-Haas et al., 2014; Frederiksen et al., 2014; Prick et  
6 al., 2014). Whereas factors that hinder their sustained participation in exercise classes  
7 include previous health conditions and frailty (Chong et al., 2014; McCurry et al.,  
8 2011), excessive content (or introduced in a speedy manner or not adapted to  
9 participants needs) (Chong et al., 2014; Frederiksen et al., 2014; McPhate et al., 2016),  
10 or adverse events (Frederiksen et al., 2014; Teri et al., 1998).

11 Despite the positive qualities attributed to Tai Chi for older people (i.e., in terms  
12 of physical and psychological improvements (Li et al., 2005; Sun et al., 2015;  
13 Voukelatos, Cumming, Lord, & Rissel, 2007)), previous exercise trials have tended to  
14 exclude people living with dementia. When people living with dementia have been  
15 invited to participate, studies have mainly focused on the effectiveness of the  
16 interventions to prevent falls and their experiences have not been explored ( Yao,  
17 Giordani, Algase, You, & Alexander, 2012). Although Suttanon et al. (2012) examined  
18 qualitatively the motivators and barriers for participants with dementia for home-based  
19 exercise to date no falls prevention studies have explored the factors associated with  
20 adherence to class-based exercise in individuals with dementia and their family carers.  
21 One previous study focused on the acceptability of Tai Chi among people living with  
22 dementia, however, this was conducted in the context of a four week Pilot Intervention  
23 Phase (Barrado-Martín, Heward, Polman, & Nyman, 2019). Hence, there is the need to  
24 study long-term barriers and facilitators to their adherence to Tai Chi classes, and  
25 whether lessons learnt have an impact on a long-term adherence intervention. Likewise,  
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1 previous exercise research in people living with dementia have scarcely linked their  
2 findings to existing theory (Yu & Swartwood, 2012). Hence, there is a lack of  
3 understanding of what people living with dementia and their carers would need to  
4 facilitate attendance to exercise classes and potentially obtain its benefits.

5 Self-determination theory (SDT) seems particularly appropriate in the exercise  
6 context as it has been found useful to understand the motivational orientation to adopt  
7 and maintain exercise behaviour (Ingledeu, Markland, & Medley, 1998). SDT  
8 postulates that individuals are driven by an innate tendency to discover their  
9 environment and satisfy three basic needs of autonomy, competence and relatedness.  
10 SDT suggests that individuals will be more likely to sustain behaviours that are self-  
11 determined, which are intrinsically enjoyable for the individual and fulfils their basic  
12 needs (Deci & Ryan, 2000).

13 The current study, embedded in the <BLINDED FOR REVIEW> Trial (Trial  
14 Registration: <BLINDED FOR REVIEW>) that was designed to explore Tai Chi's  
15 impact on people living with dementia's postural balance, aimed to understand what is  
16 influencing those living with dementia and their carers' participation in Tai Chi exercise  
17 classes. SDT was used jointly with previous research to discuss this study findings and  
18 its fit with SDT postulates regarding the relevance of the three basic needs and the self-  
19 determination required to sustain adherence to exercise practice.

## 20 **Design and methods**

### 21 *Participants*

22 Participants were recruited between April 2017 and July 2018. Recruitment sources  
23 included 3 National Health Service Trusts, and 15 General Practitioner surgeries, Join  
24 Dementia Research Website, the Alzheimer's Society and publicity (via flyers or face-  
25 to-face events attended by <BLINDED FOR REVIEW> Team) across three different

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1 research sites in the <BLINDED FOR REVIEW>. A total of 359 participants were  
2 referred and screened by the <BLINDED FOR REVIEW> Team, amongst those 86  
3 were randomized after being found eligible and willing to take part in the trial. Of these  
4 86 dyads, 42 dyads were allocated to the intervention arm and were divided into 10  
5 different groups.

6 This study sample represents participant dyads allocated to the intervention arm  
7 of the first 6 out of the 10 groups organized (n = 25). Dyads were formed of a person  
8 with dementia and their informal carer (non-professional, unpaid carer, like a family  
9 member or friend providing support). Demographic characteristics of participants  
10 included in the study are provided in Table 1 and inclusion and exclusion criteria are  
11 described in Table 2. Amongst recruited participants, three dyads did not attend any of  
12 the classes (one participant living with dementia changed her mind regarding  
13 participation in the study after randomisation and a second participant had health issues  
14 that impeded attendance to classes) or discontinued participation before being observed  
15 (one dyad due to competing commitments), and hence only 22 dyads were included in  
16 the analysis. Most participants observed during classes (n = 22) were later interviewed  
17 (n = 15) as reflected in Supplementary Material B.

18 [TABLE 1 HERE]

19 [TABLE 2 HERE]

## 20 ***Design and instruments***

21 A qualitative approach was used to explore dyads' experiences of taking part in the  
22 <BLINDED FOR REVIEW> Trial. At baseline participants' demographic details were  
23 collected through a structured questionnaire (see Table 1). Semi-structured observation  
24 sheets were used during observations of classes, to help the researcher note their  
25 observations and collect feedback from instructors and participants at the end of the

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1 classes in a systematic way. Likewise, a semi-structured schedule was used to guide  
2 dyadic interviews with dyads following their participation in the intervention (see  
3 Supplementary Material A). Data collection tools were developed based on previous  
4 research and the experiences of our Pilot Intervention Phase <BLINDED FOR PEER  
5 REVIEW>. Elements that could influence adherence as well as elements from self-  
6 determination theory such as the three basic needs were included in these sources of  
7 data collection. For instance, the interview topic guide included aspects about  
8 participants' feelings taking part in a group intervention and their willingness to sustain  
9 these relationships beyond their involvement in the study (relatedness) and how did they  
10 feel about the intensity or the level of difficulty of the classes (competence).  
11 Observation and feedback sheets, on the other side, had a box dedicated to comments  
12 made by participants during classes regarding their competence performing the moves  
13 and researcher's observations on their performance. Likewise, another box was  
14 dedicated to observations on relatedness or how participants reacted to practising with  
15 others (e.g. interacting with others, looking at others during the classes and non-verbal  
16 communication). Finally, another box was dedicated to autonomy need where  
17 participants' comments and observations on their independent and voluntary  
18 participation in the classes were captured.

### 19 ***Procedure***

20 Participants in the intervention arm were invited to join weekly Tai Chi (Chen style)  
21 classes for 20 weeks (where 8 warm up patterns, and 5 tai chi forms pattern were  
22 taught), as well as practicing at home for 20 minutes a day. Each class consisted of 45  
23 minutes of Tai Chi practice (warm-up, patterns and relaxation) with emphasis on  
24 posture and breathing plus up to 45 minutes for informal conversation with peers and  
25 Q&A with the instructor (for more detail see study protocol <BLINDED FOR

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1 REVIEW>). New warm-ups and patterns were progressively introduced over classes.  
2 During classes, the new movements were taught through instructor demonstration and  
3 verbal cues. Each movement was repeated until participants were able to follow the  
4 instructor correctly, the instructor corrected participants' moves verbally and where  
5 required also physically. Likewise, as per protocol, throughout their participation in the  
6 study (from baseline up until the follow-up home visit), participants received weekly  
7 falls monitoring calls by first author (second author acted as cover when first author was  
8 unavailable) (<BLINDED FOR REVIEW>). The classes were led by two fully trained  
9 and experienced Tai Chi instructors. The classes' venues were chosen by the research  
10 team after assessing a series of accessibility, maintenance, and suitability criteria tested  
11 in the Pilot Intervention Phase of the <BLINDED FOR REVIEW> Trial (<BLINDED  
12 FOR REVIEW>).

13 Throughout the 20-week period a researcher observed a total of 23 classes, this  
14 was made up of between 2 and 5 classes from each Tai Chi group (less observations  
15 were made when the group was left with a single dyad attending until data saturation  
16 had been reached). Feedback from participants and instructors was collected at the end  
17 of each observed class (n = 23). Additionally, instructors' notes in the class registers  
18 were also incorporated in the analysis. Around week 16, 15 dyads were invited to take  
19 part in a dyadic interview at home. A purposive sampling strategy ensured a range of  
20 participants with differing adherence experiences were included, such as dyads that  
21 were able to attend all sessions and others who were not. All dyads invited to take part  
22 in an interview agreed to take part together at their home. These interviews were audio-  
23 recorded and professionally transcribed verbatim.

#### 24 ***Researcher characteristics***

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1 Data was collected by first author who had a BSc (Hons) in Psychology, an MSc in  
2 Geropsychology and was working towards her PhD in Psychology when data was  
3 collected. She had previous clinical and research experience working with people living  
4 with dementia and their carers, but no expertise in exercise research. However, she was  
5 willing to learn about any intervention with a potential to have a positive impact on  
6 people living with dementia's lives. First author met participants over the phone at the  
7 time of their initial screening or soon after through weekly monitoring calls, which  
8 lasted throughout participants' involvement in the study. Participants knew the role of  
9 the first author within the study, and that she had never practised Tai Chi before.  
10 Participants were aware the role of the first author was to learn from their experiences  
11 and about the barriers and facilitators to their participation; and that their low or high  
12 adherence to the intervention was not the focus of first author's research, but their frank  
13 views to be able to further improve the Tai Chi intervention to meet their needs. She  
14 was interested in learning from participants' experiences, and perhaps because she was  
15 not used to exercise herself, thought people living with dementia and their carers would  
16 find difficulties in adhering to an exercise routine.

### 17 ***Ethical considerations***

18 The trial was ethically approved by the West of Scotland Research Ethics Committee 4  
19 (reference: <BLINDED FOR REVIEW>) and the Health Research Authority (IRAS  
20 project ID: <BLINDED FOR REVIEW>). Participants were provided with a participant  
21 information sheet by post and given a minimum of 48-hours to consider their  
22 participation. Written informed consent was obtained from both members of the dyad.  
23 Additionally, process consent was verbally attained at each interaction with participants  
24 (Dewing, 2008).

### 25 ***Data analysis***

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1 Field notes and interviews' transcriptions were incorporated to Nvivo.11 (QSR  
2 International Pty Ltd., Doncaster, Victoria, Australia) and thematically analysed  
3 together. Each interview was coded promptly to afford refinement of the interview  
4 probes for subsequent interviews until data saturation was reached. The 6 steps  
5 described by Braun and Clarke (2013) were used at this stage to get familiarized with  
6 the data, generate initial codes, search for themes and review those initial themes to  
7 finally write-up the report. Data was inductively coded by the first author and 10% of  
8 the data was double coded by the second author following a coding manual developed  
9 by the first author, reaching a strong level of agreement in the quotes being coded under  
10 the same codes (Kappa value: .90). Finally, resulting themes and codes were reviewed  
11 by all four authors. All three sources of data (qualitative observations, feedback, and  
12 dyadic interviews) were analysed together as no significant changes were appreciated  
13 between participants or participants and researchers accounts during data collection,  
14 which might reflect participants' comfort in reporting back to the researcher- However,  
15 the richest source of data, and particularly of quotes, were the interviews, hence most  
16 part of the quotes provided in Table 4 were extracted from those interviews. This  
17 publication presents findings related to participants' experiences of the classes, a  
18 separate publication (<BLINDED FOR REVIEW>) reports on their experiences to the  
19 home-based component.

## 20 **Findings**

### 21 *Class attendance*

22 Dyads' adherence to the classes varied widely among participants as shown in  
23 Supplementary Material B. Only three dyads attended 100% (20/20 class offered), one  
24 additional dyad attended all the classes offered since their recruitment (16 classes), and  
25 10 dyads attended at least 50% of the classes. Overall, people living with dementia

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1 attended an average of 11.4 (ranging 0-20) sessions and carers, 11.6 (ranging 0-20)  
2 sessions.

3 Class attendance is measured from the time participants were recruited into the  
4 study until the end of the study or, where applicable, the point that they withdrew from  
5 the study. Overall attendance to classes fluctuated over the course of the intervention as  
6 shown in Supplementary Material C. People living with dementia attended an average  
7 of 58.1% of the classes, whilst their carers attended 59.1% as reflected in  
8 Supplementary Material B. This difference was due to one of the participants living  
9 with dementia not being able to attend several sessions due to previous health issues  
10 (i.e., back pain), but the carer continued attending.

11 Reasons for participants or instructors' missing classes are provided in Table 3.  
12 A total of 14 sessions had to be cancelled and postponed, due to none of the participants  
13 (n=8) or the instructors (n=6) being able to attend, to ensure the delivery of 20 classes  
14 originally planned either.

15 [TABLE 3 HERE]

### 16 *Qualitative findings*

17 Within participants' classes experiences six subthemes were identified: the practicalities  
18 of the classes, instructors' characteristics, participants reactions to the intervention, class  
19 barriers, class facilitators and improvements suggested. Each theme is explained next  
20 and example quotes supporting those themes are provided in Table 4.

21 [TABLE 4 HERE]

#### 22 *Practicalities of the classes*

23 The venues and timing were generally perceived as suitable. Two carers in a venue with  
24 a big mirror at the end of the class valued this element, whereas a participant living with  
25 dementia in a class without a mirror missed it after struggling with mirroring the

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1 instructor and having practised in front of a mirror at home. When asked, Instructor 2  
2 also thought that in an ideal situation, a mirror in the class would be helpful. As shown  
3 in Table 3, the duration of the classes (45 minutes, once a week), intensity, and level of  
4 challenge were adequate for all 15 dyads interviewed. The frequency of the classes was  
5 right for participants. Only two carers in the group taking part on Mondays (which  
6 clashed with several bank holidays) highlighted in their feedback that continuity would  
7 be preferable. They all seemed to agree that less frequent classes would not help their  
8 learning process or to create a routine and they would feel the Tai Chi would lose its  
9 impact.

10 Although, in some instances, dyads were provided with one-to-one tuition they  
11 preferred to practice in the company of others. When asked, participants pointed  
12 towards an ideal number of dyads per class being between four and eight, always  
13 depending on the size of the room and the instructor's ability to monitor the individuals  
14 in the group. Both instructors agreed that small groups were a challenge as the impact  
15 on dyads missing a class or withdrawing was greater on the other participants. Likewise,  
16 the socializing component of the classes was highly valued, and frequently perceived as  
17 one of the strengths of the intervention as it gave participants the opportunity to share  
18 time with other people 'in the same boat'. Participants positively described their  
19 relationships with other participants and the instructors and felt this socializing  
20 component was important for their well-being. This component was missed when not  
21 been fully implemented (e.g. when participants had competing demands after the class  
22 or their carpark ticket was about to expire by the end of the Tai Chi session) and  
23 participants suggested this could be promoted by: 1) Allocating 10/15/20 minutes for  
24 socializing (in groups where this did not happen) and presenting it as part of the class

25 *"Well you have...you include that as a coffee break...um, and it seemed to...it...that's*

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1 *the hour. Instead of committing three quarters of an hour, you're there for an hour."*  
 2 (01022C-I); 2) Staying in the same room for socializing in the case of group 2 where  
 3 they were required to move to another room on a different floor (however, another  
 4 participant in this group thought this would have not been a difficulty) "*Well I think if*  
 5 *we didn't have to move. (...) But the fact that we've all got to pack up and walk up to*  
 6 *that room upstairs and then the kettle has to go on makes it all a bit time-consuming."*  
 7 (01002C-I). and; 3) Choosing a different room environment inviting to socialize in a  
 8 more natural way (as reported in group 3 and 5 where refreshments were offered in the  
 9 same venue). "*I mean, the <Venue 3> Centre is not exactly designed for sitting around*  
 10 *and having a chat is it (...) ...it just wasn't as...you know, like a sit down and socialize*  
 11 *sort of looking place."* (03008C-I).

#### 12 *Instructors' characteristics*

13 Despite the attempts to deliver the classes in a similar way, instructors showed some  
 14 differences in their teaching styles. For instance, whereas Instructor 1 seemed more  
 15 concerned about participants performing the movements exactly as instructed (and used  
 16 more direct correction), Instructor 2 delivered the classes in a professional but more  
 17 relaxed way, including the use of jokes and personal anecdotes during the classes.  
 18 Regardless of these differences, however, both instructors received positive feedback  
 19 from the participants. Participants frequently pointed Instructor 1's strengths were her  
 20 patience, authenticity and her way to welcome the participants, as well as her attentive  
 21 manner. Participants guided by Instructor 2 described him as an excellent instructor who  
 22 created a failure free environment and explained the tales behind the movements which  
 23 made the classes interesting.

#### 24 *Participants' reactions*

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1 Participants kept focused on the instructor during the classes and had little interaction  
2 with other participants or the instructor. Some participants tended to spontaneously  
3 comment more during the classes and were acknowledged by instructors with a  
4 reassuring response. Conversation between members of the dyad or with other  
5 participants during the classes was mostly non-existent except when one of the  
6 participants needed occasional carer's support in executing the movements or if there  
7 had been a joke between participants and the instructor.

8 Participants seemed to welcome both direct and indirect corrections. Two  
9 participants living with dementia expressed their willingness 'to do it [Tai Chi], the way  
10 it's got to be done' (01002P, 03003P). One carer felt physical support and corrections  
11 were crucial for the person living with dementia to learn the movements the right way  
12 and achieve the expected benefits. One carer and two people living with dementia  
13 reported some potentially negative feelings around corrections. However, these were  
14 only initial feelings that did not impact on their enjoyment of the classes or their  
15 impressions about Instructor 1.

16 Participants reported at the end of the classes their expectation that movement  
17 execution would get easier over time. Interviews confirmed this notion. Both people  
18 living with dementia and their carers appreciated that the more repetition, the more they  
19 could feel the flow when engaging in Tai Chi. Repetition provided feelings of  
20 improvement in their performance over sessions, which was supported by instructors.

21 Eight participants living with dementia and three carers perceived their ability to  
22 perform the movements was worse than others, that they struggled with some particular  
23 movement or part of their practice, or their ability had worsened after a experiencing a  
24 stroke or fall (unrelated to Tai Chi). Most participants were able to identify their own  
25 strengths and weaknesses during their practice and were confident their performance

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1 could improve with further practice. This encouraged them to keep practicing Tai Chi  
2 and willing to continue with the classes as one of the dyads who joined Instructor 2's  
3 private lessons once their participation in the study finished (e.g. dyad 01012).

4 Three participants living with dementia described their learning process as a  
5 natural process, something they were learning from the instructor during the classes  
6 implicitly. One of the participants living with dementia who experienced two strokes  
7 during her participation in the study and had to discontinue her practice reported she  
8 was still capable of remembering the movements when back practicing. Similarly,  
9 another dyad was able to resume and catch up with the classes after missing several  
10 sessions when recovering from an accident.

#### 11 *Class barriers*

12 None of the participants reported any reluctance to attend classes. On the contrary, the  
13 potential benefits were perceived to be more important than potential difficulties to  
14 attend (i.e., time of the classes) and that they would miss the Tai Chi classes once their  
15 participation in the study would be finished.

16 Only one dyad described Tai Chi as a 'boring' activity (01022), however, they  
17 admitted their previous exercise history might have impacted on their experience of Tai  
18 Chi, as both the person living with dementia and the carer were used to higher intensity  
19 exercises (i.e., personal trainer and cardio exercises). Their continued attendance to the  
20 classes was motivated by the chance of getting health benefits from Tai Chi and their  
21 commitment to the study. One additional carer perceived Tai Chi not to be a suitable  
22 activity for her in a dyadic setting as she did not feel able to relax. She might have  
23 continued for the benefit of her mother living with dementia but would have preferred to  
24 continue in a separate group (i.e., Tai Chi carers group). This was not the reason for

1 their withdrawal, however, this last dyad ended up withdrawing from the intervention  
2 after her new job clashed with the Tai Chi classes.

3 A limitation of Tai Chi pointed out by one person living with dementia was that  
4 it took them a while to familiarize themselves with the movements. This was probably  
5 increased in this dyad's case as they joined the intervention later and the person living  
6 with dementia struggled with getting used to the mirroring.

7 Twelve participants living with dementia reported a health issue that interfered  
8 with their class Tai Chi practice at some point (i.e., not allowing participants to copy the  
9 movements or feeling discomfort when doing it). Less than half of them had to sit for a  
10 little while during the classes because of diabetes, low blood pressure, feeling wobbly,  
11 dizzy spells, balance difficulties, back pain, or shoulder problems. They joined the class  
12 following a short break and this did not result in dyad's withdrawing from the  
13 intervention. Participants (ten of them) and instructors reported Tai Chi specific  
14 difficulties. These included left right differentiation, getting relaxed, copying the  
15 movements, remembering the movements, doing the footwork, mirroring, or practicing  
16 with little verbal guidance.

### 17 *Class facilitators*

18 Overall, participants reported that they enjoyed their participation in the classes, both  
19 people living with dementia and their carers were looking forward to attending the  
20 classes. It was observed and later confirmed in the interviews that a couple of  
21 participants living with dementia attending classes had difficulties recalling why they  
22 were at the venue before the start of the class. However, such difficulties expressed also  
23 by another two participants living with dementia did not impede them enjoying the  
24 classes. Three younger carers with an age gap with the person living with dementia (>10  
25 years) expressed some surprise towards the person living with dementia's enjoyment of

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1 Tai Chi, either for the way they positively reacted to it or the difficulties they faced to  
2 find an activity the person living with dementia was interested in.

3       Enjoyment and socializing opportunities were reported by all as two of the main  
4 factors associated with adherence. Two carers also liked the helpful environment and  
5 the instructors were also acknowledged for their motivational qualities by four dyads.

6       Dyads expressed the exercise itself, the potential benefits (i.e., helping to keep  
7 fit, feeling well afterwards), the habit of attending classes, the environment  
8 characteristics (i.e., failure free), and the enjoyment of specific parts of the session (such  
9 as the warm-ups or the integration between foot and arm work, when they felt were  
10 ‘actually doing the Tai Chi’) helped them to keep attending the classes.

11       An additional motivator was the fact that Tai Chi gave the participants the  
12 possibility of practicing exercise together, which for some participants was a must or an  
13 incentive (i.e., ‘It's always nicer if you've got someone to go with.’ 01009P). The Tai  
14 Chi was described as potentially beneficial for both members, though three carers  
15 verbalised the target of the Tai Chi classes were those living with dementia. Lastly,  
16 more altruistic motivations such as helping people living with dementia and a firm  
17 commitment to the study were also mentioned as facilitators of classes’ attendance (by  
18 two carers and 3 dyads respectively).

#### 19 *Suggested improvements to the classes*

20 Most dyads were happy with the classes. Ten dyads suggested the following  
21 improvements: a) Possibly increase the number of dyads per class, recruiting younger  
22 people living with dementia, or participants at earlier stages of dementia progression;  
23 b) Set up a morning class instead of late afternoon class as getting home when it is dark  
24 might be off-putting for older people; c) Offer another class for carers with less pausing  
25 or give the option for the person living with dementia to attend on their own so the carer

Barrado-Martín, Y., Heward, M., Polman, R., & Nyman S. R. (in press). Adherence to  
the class-based component of a Tai Chi exercise intervention for people living with  
dementia and their informal carers. *Journal of Aging and Physical Activity*.

1 can take some respite; d) Offer an outside practice in the summer; e) Keep verbal  
2 guidance throughout the classes; and f) Enhance the socializing component (see  
3 Practicalities of the classes).

#### 4 **Discussion and implications**

5 Adherence is often reported as a challenge in exercise research. To our knowledge, this  
6 is the first study that qualitatively explores the adherence of those living with mild-to-  
7 moderate dementia and their carers to a class-based Tai Chi intervention. It builds on a  
8 previous study that qualitatively explored the acceptability of such intervention limited  
9 to a small number of classes (Barrado-Martín et al., 2019), providing further  
10 understanding on long-term barriers and facilitators to their adherence. Such exploration  
11 is key to understand the barriers and facilitators to class attendance identified by dyads  
12 with different adherence levels (and different dyadic relationships) throughout a longer  
13 study period. Furthermore, this is one of few exercise studies to include the voices of  
14 people living with dementia and their informal carers by observing their experiences  
15 and using dyadic interviews. Hence, this study makes a unique contribution to the  
16 understanding of the needs of people living with dementia and their carers to sustain  
17 their participation in Tai Chi exercise classes that could contribute to their wellbeing.  
18 This study highlights the value of using qualitative methods alongside trials as changes  
19 implemented to the intervention (e.g. reducing the number of patterns to learn  
20 throughout the course) after the lessons learnt from Barrado-Martín et al. (2019), were  
21 not raised as a barrier in the longer intervention.

#### 22 ***Adherence facilitators***

23 Several aspects of the classes have contributed to participants' adherence to the 20-week  
24 class practice in line with previous research findings: a) The enjoyment of the classes  
25 (Frederiksen et al., 2014; McPhate et al., 2016; Jacqueline Wesson et al., 2013; Yu &  
Barrado-Martín, Y., Heward, M., Polman, R., & Nyman S. R. (in press). Adherence to  
the class-based component of a Tai Chi exercise intervention for people living with  
dementia and their informal carers. *Journal of Aging and Physical Activity*.

1 Swartwood, 2012); b) The group-based setting with its inherent socializing component  
2 with similar others (Burgener et al., 2008; Dal Bello-Haas et al., 2014; Frederiksen et  
3 al., 2014; Yao et al., 2012); c) The friendly and task-oriented environment of the classes  
4 where improvement resulted from repetition and effort, and where instructors invited  
5 participants to avoid comparing themselves with others (Barnes et al., 2015); d) Their  
6 dyadic participation (Yao et al., 2012); and e) The perceived benefits of Tai Chi  
7 (Logghe et al., 2011). Additionally, weekly monitoring calls were perceived by some  
8 individuals as an encouragement for their attendance to the classes. Despite not being  
9 the purpose of these calls, this could have acted as a facilitator in line with previous  
10 research findings (Frederiksen et al., 2014; Hawley-Hague, Horne, Skelton, & Todd,  
11 2016; Lam et al., 2012). Likewise, the ability of people living with dementia to  
12 remember and perform the movements could have acted as a facilitator to their  
13 adherence to the Tai Chi classes. In addition, their progress in movement execution and  
14 their enhanced physical self-perceptions can help explain willingness to keep practicing.

### 15 *Adherence barriers*

16 Reasons for participants being unable to attend sessions are aligned to those reported in  
17 the literature. Amongst them, changes in health (including adverse events) or worsening  
18 health conditions affecting the person living with dementia or the carer (Chong et al.,  
19 2014; Farran et al., 2008; Prick et al., 2014; Suttanon, Hill, Said, Byrne, & Dodd, 2012;  
20 Wesson et al., 2013), competing commitments (Suttanon et al., 2012), or holiday  
21 periods (Wesson et al., 2013) were the most common. In our study health-related issues  
22 affecting the person living with dementia or the carer accounted for 81% of the sessions  
23 missed. This had an important impact on the overall adherence of people living with  
24 dementia and their carers (58.1-59.1% respectively) despite reporting no reluctance to  
25 attend classes. Consistent with previous research, in-class barriers such as occasional

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the class-based component of a Tai Chi exercise intervention for people living with  
dementia and their informal carers. *Journal of Aging and Physical Activity*.

1 dizziness or physical discomfort (i.e., back pain) (Teri et al., 1998) led to a brief  
2 interruption of the Tai Chi practice. Similarly, difficulties to remember the Tai Chi  
3 moves (i.e., when the instructor was standing with their back to the participants)  
4 previously found amongst older adults in the community (Logghe et al., 2011),  
5 triggered one of the dyads to drop out.

### 6 *Self-determination theory (SDT)*

7 Participants joined the study aspiring to get a health benefit from their participation in  
8 Tai Chi. According to SDT, taking part in exercise for health benefit is considered an  
9 external form of behavioural regulation. It is not uncommon that during the adoption  
10 phase of a more active lifestyle participants are more motivated by such external  
11 motives. However, following continued participation behaviour becomes more  
12 internalized and intrinsic motives (i.e. enjoyment) can come to dominate motivation for  
13 continued engagement in the activity (Ingledeu et al., 1998). This process was  
14 facilitated by the class environment and the instructors' behaviour that generated a task-  
15 oriented motivational climate through the use of constructive and informative feedback  
16 and discouragement of comparisons (Eys et al., 2013; Farrance, Tsofliou, & Clark,  
17 2016). At the same time, the dyad nature and the provision of socialization opportunities  
18 assisted in developing relatedness (Annesi, Unruh, Marti, Gorjala, & Tennant, 2011;  
19 Farrance et al., 2016). The satisfaction of competence and relatedness needs, together  
20 with the intrinsic enjoyment obtained through their practice would have assisted in  
21 participants' continued participation in the classes (Lee, Arthur, & Avis, 2008). The  
22 basic need of autonomy was not relevant in the context of group classes, as participants  
23 were there voluntary and nor carers or instructors forced their practice during the classes  
24 (e.g. were able to stop if they felt unwell, and were practicing on their own throughout  
25 classes).

Barrado-Martín, Y., Heward, M., Polman, R., & Nyman S. R. (in press). Adherence to the class-based component of a Tai Chi exercise intervention for people living with dementia and their informal carers. *Journal of Aging and Physical Activity*.

1           Additionally, this study findings suggest the usefulness of social cognitive  
2 theory as well in that performance accomplishments (Neupert, Lachman, &  
3 Whitbourne, 2009), verbal persuasion from professional instructors (Burton, Shapiro, &  
4 German, 1999) and vicarious experiences (Lee, Avis, & Arthur, 2007) might have been  
5 relevant for participants' adherence to the classes. Over the sessions, participants  
6 perceived their own improvement and realized they were able to perform the  
7 movements they initially found challenging. This way participants experienced mastery  
8 and developed their physical self-efficacy beliefs. Importantly, this study demonstrates  
9 that people living with dementia were actively able to participate in Tai Chi and  
10 improve in their performance over time. Participants reported getting familiar and  
11 progressively learning the moves, despite possible initial difficulties, which enhance  
12 their perceptions physical self-efficacy. Overall, Tai Chi might be less suitable for those  
13 preferring more vigorous activity but challenging enough for those with less exercise  
14 experience. An optimal challenge appeared to be offered to the majority of participants  
15 in the <BLINDED FOR REVIEW> Trial as were able to develop their Tai Chi skill  
16 (Guadagnoli & Lee, 2004).

### 17 ***This study's strengths***

18 An important strength of the current study was the use of field notes to collect 'in situ'  
19 feedback from participants living with dementia, which enabled capturing comments  
20 from participants (i.e., describing the relaxed environment of the classes and  
21 encouraging themselves to give a go to Tai Chi). These details might or might not have  
22 come up in the context of the interview, which were generally scheduled within sessions  
23 (on average 3 days after the most recent session). Secondly, being in touch with  
24 participants to collect data for the <BLINDED FOR REVIEW> Trial contributed to a  
25 natural development of rapport with the first author which helped the participants open  
Barrado-Martín, Y., Heward, M., Polman, R., & Nyman S. R. (in press). Adherence to  
the class-based component of a Tai Chi exercise intervention for people living with  
dementia and their informal carers. *Journal of Aging and Physical Activity*.

1 up when she undertook the interviews. As well being involved in the collection of all  
2 data the first author gained an overview of the data set that enabled her to determine the  
3 consistency of the data collected during the classes and the interviews (enhancing  
4 credibility and dependability) and triangulate the findings. Finally, this study placed the  
5 person living with dementia at the centre and confirmed participants living with  
6 dementia's ability to contribute and be satisfied with their participation and input to the  
7 interviews, which supports future qualitative work with this group. The dyadic setting  
8 facilitated the data collection process as carers were able to make clarifications in a  
9 familiar environment.

#### 10 ***This study's limitations***

11 Because of slow recruitment into the trial, the groups observed, and dyads approached  
12 to participate in interviews were from the first six Tai Chi groups rather than  
13 representative of all 10 groups organized. Measures of in-class participation were not  
14 used, which does not allow a precise evaluation of their adherence (e.g., in terms of  
15 intensity) during the classes. In future studies this limitation could be overcome by  
16 video-recording the classes. Furthermore, participants who discontinued their  
17 participation were interviewed several weeks after having attended their last class as  
18 interviews were due around week 16 (i.e., 5 dyads had not attended classes for 6  
19 consecutive weeks on average, ranging from 1 to 9, prior to the interview). Hence,  
20 future research might benefit from scheduling these visits as soon as possible after early  
21 discontinuation of the classes (i.e., if not immediately after the class, then the next day)  
22 to facilitate recall. Likewise, an exit interview with all participants who withdrew from  
23 the study would have been useful. The impact of small groups, withdrawal or  
24 discontinuation added to health issues and competing commitments (e.g. medical  
25 appointments) resulted in 27% of the sessions being run for one dyad only. Future

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1 research would benefit from larger groups to promote the group approach. Similarly, the  
2 dyadic format of interviews might have impacted on dyads' willingness to share the  
3 weaknesses of taking part together in the intervention together to avoid upsetting the  
4 other person.

#### 5 **Implications for practice**

6 Findings of this study suggest that community-based interventions for individuals with  
7 mild-to-moderate dementia can be successful when conducted with a significant other  
8 (dyadic approach) (Moon & Adams, 2013). However, giving people living with  
9 dementia the choice to join on their own could facilitate access, particularly to those  
10 living alone (Rollin-Sillaire et al., 2013). The provision of normalised exercise (i.e., Tai  
11 Chi, which is also practiced by people living without dementia or other conditions)  
12 (Nyman & Skelton, 2017) for a group of people living with the same diagnosis (i.e.,  
13 dementia) in the community is preferred. A Tai Chi program could benefit from  
14 multiple sessions per week on similar days and times to contribute to adherence and  
15 learning. Exercise interventions for people living with dementia should include  
16 substantial repetition of movements to facilitate such learning (Fenney & Lee, 2010;  
17 van Halteren-van Tilborg, Scherder, & Hulstijn, 2007). It is also important to have  
18 instructors who create a task-oriented motivational climate through instruction and  
19 positive feedback. Providing opportunities for socialising post-exercise also enhances  
20 participants' enjoyment and likelihood of continued participation in the activity (Farran  
21 et al., 2008; Frederiksen et al., 2014; Hawley-Hague et al., 2016; Lam & Cheng, 2013).  
22 Finally, in light of this study findings and to ensure the viability of the program, groups  
23 should be larger to allow its continuity when participants living with dementia and their  
24 carers inevitably experience health issues or adverse events that impact on their  
25 adherence to the classes.

Barrado-Martín, Y., Heward, M., Polman, R., & Nyman S. R. (in press). Adherence to the class-based component of a Tai Chi exercise intervention for people living with dementia and their informal carers. *Journal of Aging and Physical Activity*.

## 1 **Conclusions**

2 The findings of this study suggest the ability of people living with dementia to learn a  
3 new exercise and appreciate their progress over time. The provision of an optimal level  
4 of challenge to the group class, accompanied with a failure free environment which has  
5 a task-oriented focus, the use of repetition, and supportive and accessible instructors can  
6 facilitate dyads enjoyment of the classes. Additionally, the social component of the  
7 class might be an incentive to their sustained participation and a way of fulfilling their  
8 needs to relate to others outside their usual social networks. Overall, Tai Chi classes  
9 might provide people living with dementia with a normalized, accessible and enjoyable  
10 activity to share with their informal carers. Future research would need to explore  
11 participants' adherence to Tai Chi classes in larger groups which could facilitate their  
12 viability in community settings.

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