1. **Background**

Big Moves program is for individuals with Parkinson’s Disease (PD) that includes interventions focusing on high intensity exercise training, dual-task and amplitude/speed mixed with music and dance therapy that utilizes the Social Ecological Model. Progress of participants will be monitored through outcome measures focusing on various domains related to overall health to help change and better the program over time.

The first section of the program utilizes components in which the name “Big Moves” comes from: high intensity exercise, dual task, and amplitude/speed interventions. In a randomized controlled trial (RCT) looking at a high-intensity agility intervention for PD patients using sensorimotor and visuomotor agility program consisting of gait training, coordination training, posture training w/ and w/o sensory input, balance exercises, and body-scheme exercises, it improved patients clinical symptoms, mobility, and standing balance by functionally meaningful margins.1 The Big Moves program will plan to utilize similar interventions (gait, coordination, posture, balance) through dance and provide the therapy in a gym/dance studio where mirrors surround the room to provide a similar feedback that the virtual training this study used. Valenzuela et al2 showed in a RCT looking at dual-task (walking and cognitive or motor arm tasks) compared to single-task (gait training) that the dual-task group had greater improvements in velocity, stride-length, and quality of life. Additionally, dual-task training has been shown to improve spatiotemporal gait parameters and static postural control for up to 6 months after training which is meaningful in a progressive disease.3–5 Thus, the Big Moves program plans to utilize dual-task of walking/steps in a dance therapy combined with either arm movements or cognitive tasks to address similar areas. The ideology that speed increases with movement amplitude as a rehabilitation has been studied in patients with PD through LSVT-BIG and has shown to improve speed-amplitude scaling relations across upper and lower limbs and be applied to a variety of tasks and contexts.6 Therefore, in order to address high-intensity, dual-task, and amplitude/speed interventions, the Big Moves program plans to have a 10 minute warm-up and cool-down and 40 minute high-intensity exercise through dance/music therapy utilizing dual-task and large amplitude/speed movements to improve functional movements, cognition and quality of life in participants. Following the Social Ecological Model, to educate the participants/family, there will be handouts explaining the benefits of the components mentioned to increase knowledge (intra/interpersonal) and given out in the area to enhance awareness of the program(community).

The second portion of the program uses dance/music therapy. PD causes rigidity, postural instability, tremor, bradykinesia, cognitive disorders, time and spatial perception deficits, and alterations in balance which directly interferes with gait leading to decreased step length, cadence, and slower pace restricting functional independence and quality of life.7 These changes deteriorate functioning so addressing these areas are crucial. Benoit et al8 determined when using a protocol with 8 minutes of sound stimulation and 2 minutes of walking 3 times a week every month, it was found to improve both motor and gait performance. Additionally, this same study reported dance to increase postural stability enhancing balance during motor gait adjustments.8 Thus, dance and sound stimuli can improve gait. Not only does music and dance therapy enhance functional ability, but it was found that dance can improve quality of life due to greater relaxation, independence, and better mood and emotion.9–11 Furthermore, dance therapy has shown to effectively impact non-motor functions including executive function assisting in cognitive decline.7 Also, dance therapy has promoted dynamic gait changes that can last 1 month(+) after the intervention showing the short-term benefits and a tango program even showed ability to modify progression of disability which can be a big difference in maintaining independence in a progressive disease.12,13 There have been multiple studies looking at various types/regimes of dance/music therapy suggesting the type and how they are used is subjective, but the outcomes remain constant.7 Thus, the Big Moves program plans to utilize various music cues and dance types to help meet everyone’s likings, but utilize at least 8 minutes of sound and 2 minutes of walking/step movements to get the benefits noted.8 The program will focus on components of the Social Ecological Model by educating patients on the benefits of these interventions to help maintain functional ability and reduce further progression (intrapersonal) and utilizing group therapy and even partner dancing at times to impact recruitment, enjoyment, outcome and participation in classes (interpersonal).14

People with PD experience deterioration of body function, activities, and participation.15 Thus, therapy is aimed to maximize functional ability and minimize secondary complications byway of functional movement, cognitive strategies, and education to enhance independence and QOL.15,16 Therefore, outcome measures used should reflect these areas to determine if progress/regression has occurred. Following the Social Ecological Model, it’s imperative to educate the individuals of the point of the measures to enhance motivation to try their best (intrapersonal) as well as share results with family/friends to best support the participant with a progressive disease (interpersonal).

The Dynamic Gait Index (DGI) is an outcome measure recommended for individuals with PD that evaluates vestibular and non-vestibular balance, functional mobility, and gait.17 This measure is helpful for a community program as there has been determined a MDC (2.9 pts) and adequate cut-off scores for fallers and non-fallers (<19 pts) for PD population which can help determine if change over time is meaningful and when individuals may need a referral for fall prevention.17 The psychometric properties include excellent test retest reliability (ICC > 0.99), adequate concurrent validity (r = -0.57), and moderately responsive to change (mean change = 4.72).17 By using this measure, which is proven valid and reliable, the community program can help determine change relative to balance, functional mobility and gait in PD population which are imperative skills for increased independence and daily functioning.17

Mini-Mental State Examination (MMSE) is a screening tool that assesses cognitive impairment and changes over time and is recommended for PD population.18 The psychometric properties for PD population includes normative data for what to expect with change over time, significant test/retest reliability, and excellent convergent validity between MMSE and Addenbrooke’s Cognitive Examination (r = 0.72).18 Also the MMSE has determined SEM and MDC for both mild and major neurocognitive disorders, cut-off scores and normative data as individuals progress.18 Aerobic exercise, which is targeted with the Big Moves program, is a viable intervention for individuals with PD to help improve cognition (executive functioning).19 As many as 80% of individuals with PD develop cognitive impairments showing the importance of examining this function in an outcome measure.19

The Parkinson’s Disease Questionnaire-39 (PDQ-39) is the most widely used self-report questionnaire which assess disease-specific dimensions of functioning and well-being.20–22 This measure assesses health-related quality over 8 domains: activities of daily living, attention and working memory, cognition, communication, depression, functional mobility, quality of life, social relationships, and social support.20 This outcome measure is highly recommended for all Hoehn and Yahr stages of PD making it applicable to individuals despite the progression over time.20 The psychometric properties show excellent internal consistency (.84-.94), high reliability (0.68-0.95), excellent convergent validity (r = .60), absent/negligible floor/ceiling effects (0-14.9%), and even determined SEM and MDC for all components.20 It should be administered either every month (as that is when individuals are supposed to reflect on to answer the questions) or be implemented throughout the duration of the program when applicable at timeframes over one month.20 QOL measures are important for PD as it is a progressive disease.22 Specifically, PD affects QOL due to limitations in activity, social isolation, and enhanced dependence on others, thus why it's crucial to measures its effects.15 The Big Moves program emphasizes various physical interventions (dual-task, high-intensity exercise, and amplitude/speed) which all have been shown to enhance QOL.23 Thus, this program aims to improve QOL emphasizing the need to track this component with the PDQ-39.

Implementing these evidence-based interventions centered around the Social Ecological Model, the Big Move program is aimed to help individuals with Parkinson’s to improve overall health and well-being by addressing key areas affected by the disease.

1. **Program Goals**

Ultimately, this program aims to educate and enhance physical, cognitive, and psychosocial functioning of individual with PD. The following goals are what the program hopes to achieve by the end of the 12-week program.

1. Participants will report compliance with reading through education handouts about the program at home with their family by 4-weeks to demonstrate improved understanding of the program to assist in helping intrapersonal and interpersonal levels of change and self-management for possible interventions when the program ends.
2. Participants will improve in their dynamic gait index test by an average of greater than 2.9 points to meet the minimal detectable change in this outcome measure by the end of the 12-week Parkinson’s Disease community program to demonstrate improvements in balance, functional mobility and gait.17,24
3. Participants will increase by an average of greater than 12.24 on mobility, 16.72 on activities of daily living, 14.22 on emotional well-being, 22.12 on communication, and 24.50 on social support sections on the Parkinson’s Disease Questionnaire-39 to meet the minimal detectable change for this outcome measure by the end of the 12-week program to demonstrate improved health related quality of life in these areas to show improved intra/interpersonal changes based on the Social Ecological Model.20,21
4. Participants will maintain or improve their MMSE score by 6.43 points for individuals with mild neurocognitive disorders and 6.16 points for major neurocognitive disorders above the minimal detectable change in this outcome measure by the end of the 12-week program to show either sustained or improved cognitive status.18
5. **Methods**
6. **Personnel** 
   1. Participants are individuals with Parkinson’s Disease wanting to enhance their functioning, cognition, and quality of life in hopes of slowing down the progression of the disease and prevent secondary complications.
   2. Local physical therapists with neurological condition experience in the triangle area (Raleigh, Durham, Chapel Hill) will be recruited to volunteer their time to assist in implementation of the program for each session (12 total sessions) as well as local PT students from Duke and UNC that are interested in building their resumes prior to graduating. DPTs will have an incentive of participating by the program qualifying for continuing education credit that can be used for maintaining licensure.
   3. The location has a large studio, but with Covid precautions, we will only allow 20 (out of the 50 occupancy) participants per class so the 2 PTs there can each oversee watching 10 individuals each.
   4. Additional volunteers (5 needed per class) will be recruited to assist in set-up, take-down, and doing the exercises with the participants to assist in keeping an eye on all individuals, helping with movements, and enhancing motivation. These volunteers can include the PT students from neighboring universities as well as community individuals. Volunteers will be recruited through emails provided to both UNC and Duke PT programs as well as flyers at local high schools and colleges in the triangle area. Instructions will be given to the volunteers in the 30 minutes prior to the start time of the sessions to allow for all individuals to be prepared and ready to help prior to the start of each session as well as a practice run of the 10 minutes of repeated sound/step exercises so they know how to do it properly.
7. **Location**
   1. Premier School of Dance – Cary, NC. This dance studio provides mirrors on the walls and has bars that can be used for support for participants and even chairs that can be used if needed. It is owned by a family-friend of Big Moves start-up director, Maureen Marquie, so a deal was struck between the friends to allow for sessions to be held on the day the studio is closed (Sundays) in the afternoon. To compensate for the water and energy for the room/bathrooms for each session, the owner generously is charging $100 per day ($1,200 for 12 sessions) to use the studio. Thus, if 20 participants come per session for 12 sessions, then it will cost each participant $60 for the entirety of the program. This location is also helpful as it is near a community bus-line for those who need transportation making it appeal to a wider audience of participants who may be unable to drive/be driven.
8. **Enrollment and Program Schedule** 
   1. Participants will learn about the program from posted flyers throughout the triangle area as well as through neurological physical therapists providing knowledge to potential patients. Specifically, the posters will be located at local neurologist offices, PT clinics, and at local gyms and common downtown spots (downtown Chapel Hill, Durham, Raleigh). To help notify volunteers the flyers will be posted at DPT programs as well as schools, gyms, and in the same downtown areas.
   2. The flyers will have little removable tags on the bottom including the website and phone number of the director (Maureen Marquie) where they can enroll by filling out an online form or simply calling to enroll by a certain date. With the hope of spreading out in doors to limit exposure to Covid-19 and occupancy space at the dance studio, 20 participants per enrollment period can be enrolled.
   3. Four sessions (first, 4th, 8th, and 12th session) will have a Saturday booked at the same location from 1-3 pm to assist in collecting outcome measures where additional volunteers and PTs will be utilized (3-4 PTs, 5-7 Volunteers) to speed up the process. Once individuals are enrolled the 12-week program and baseline measurements have been taken, sessions will begin. Each Sunday at the program at the Dance Studio, participants will check in at volunteer stations at the front of the studio to help keep track of individuals at 1 pm when each session will be held.
9. **Intervention Specifics** 
   1. The session will begin with active stretching for a light warm up at the studio (big movements including big arm swings over the head to reach the toes, 60 second holds for hamstring and quadriceps while holding onto the bar in the studio if needed, etc.). This will last approximately 10 minutes and can be performed sitting or standing depending on the patient preference as chairs will be allocated to participants if needed. 10 minutes of warm-up has been shown in a dual-task study for PD to be adequate time for the participants to get ready prior to the intervention so the same timeframe will be utilized.2 Dance and music therapy as mentioned in the background has been shown to help postural stability enhancing balance during motor gait adjustments, increase quality of life, and even prevent cognitive decline.8-11 The dance therapy that will be utilized is Zumba. Zumba Gold (®) has been shown to be a safe and enjoyable intervention for individuals with PD with no adverse effects.25 Zumba is a great dance therapy option for individuals with Parkinson’s as it uses Latin music with a distinguished beat to follow and salsa dance which has been shown to have positive impacts on PD patients and is a high intensity exercise which further increases the benefits.26 This strong beat in the Latin music will allow the participants to perform the 8 minutes of sound and 2 minutes of walking/step movements that research has shown for best results.8 The director will work with the owner of the dance studio (who teaches Zumba) to come up with a choreographed dance to do to the Latin music utilizing salsa moves as well as dual-task and big amplitude movements and will become certified prior to the beginning of the program. The dual task will include using both arm and leg movements at the same time as it has shown to improve spatiotemporal effects of gait.3-5 The specific movements that will be performed throughout the dance will include components of the outcome measures: Functional Gait Assessment and the Mini Balance Evaluation Systems Test as these motor tasks in these measures has been highly recommended for the use in individuals with PD and thus, by practicing the movements in these measures, the greater likelihood to enhance the outcomes the program is after.27 Some examples of these movements include rising onto toes, sit to stand (using the chairs provided), stance with feet together with big arm movements, stepping over obstacles (box while having bar nearby for support), taking forward, back and lateral steps with head turns ,etc.27 Lastly, to get the big amplitude movements desired, the PT and volunteers will be encouraging the individuals to do large movements so when turning their head side to side they can even turn their body, etc. This way the intervention gets the high intensity, dual-task, big amplitude movements into the dance/music therapy that is after.

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| 10-minute warm-up | 8 minutes | 2 minutes | Repeat previous 10 minutes x3 times |
| Big stretches for large amplitude (using arms and legs as well as static holds) | Sound movements:  -following the beat of the music do the movements (rise onto toes, sit to stand, etc.) to beat of sound | Stepping (lateral, forward, backward, marching steps following the song beat) | Same exercises as previous 10 minutes |

* 1. Handouts will be made by the director (who will be a PT) explaining the benefits based on the evidence-based research as described in the background of each specific intervention as well as each outcome measure to help enhance knowledge of the individual (intrapersonal level) as well as to help educate the family/friends that are likely assisting in transportation and helping the individual on a daily basis with the disease to understand and help support the participant (interpersonal level). Thus, these educational handouts will be impacting two layers of the Social Ecological Model to help increase the likelihood of creating a new habit of keeping up with these sessions.
  2. Assessments (Dynamic Gait Index, Mini-Mental State Examination, and the Parkinson’s Disease Questionnaire-39) will be performed at baseline, 4-weeks, 8-weeks, and at the last session. The DGI will require a box (shoebox) and cones (2) provided by the director as well as a walkway and set of stairs which the studio has.17 MMSE is easiest computed and done on a computer so the PTs and volunteers will be asked to bring their computers on the day of assessments to quickly and easily perform this measure.18 Lastly, the PDQ-39 will be provided by the CRC as they voluntarily donated them to be used for the clinic as many of their patients will likely come to the program. To help enhance participant knowledge of scores, patients will be given their assessment scores to keep track of their progress as well as an excel sheet holding the data (taken by director) with scoring meaning provided on them such as DGI score < 19 means at an increased falls-risk to help patients understand what their scores mean.17

1. **Program Evaluation**

Big Moves program will utilize assessments to determine how the participants are doing based on motor function, cognition, and quality of life to assist in determining how the interventions are working and if adjustments are needed. Assessments will be performed at entry into the program to determine a baseline value to compare additional timeframes too as well as at 4-weeks, 8-weeks, and at the end of the program at 12 weeks. A licensed physical therapist will perform these measures and will provide training to volunteers or will do it themselves to score them. The program also will have an optional assessment where individuals can come back in at 1 year following the program to help determine longevity of benefits seen as there are limited studies showing the impact of therapeutic interventions in the long-term.28 The assessments looked at will include the DGI, MMSE, and the PDQ-39 as well as participants confirming compliance with reading through the handouts of the program with their family. By the end of the program, participants should increase their DGI score by greater than 2.9 points, improve their PDQ-39 scores by greater than 12.24 for mobility section, 16.72 for ADLs, 14.22 for emotional well-being, 22.12 for communication, and 24.50 for social support sections to show improvements in quality of life.17,20,24 Additionally, by the end of the program the participants should maintain or improve their MMSE score by 6.43 points.18 All values are indicative of a minimally clinical difference and thus the program aims to surpass that value to create a minimally clinically meaningful change. By having 4 separate timeframes for assessments, it allows for seeing change over time and improving the program throughout while participants are still in it, rather than just at the end for future participants. Thus, by improving at each assessment timeframe and reaching the program’s goals, participants will demonstrate attribution: that their growth is meaningful, and the program is successfully working.29

Additionally, besides assessing the program through outcome measures, both participants and personnel will complete satisfaction surveys to help determine areas that are working, areas that need improvement and individual’s other thoughts about the program. These will be done at 6 weeks (halfway) and 12 weeks (end of the program) but will be available at each session in case thoughts arise before then. In general, the satisfaction survey will address implementation, effectiveness, efficiency, and cost-effectiveness to meet all areas of program evaluation based on the CDC guidelines.29 That is, the survey will have questions regarding satisfaction with the overall program and if individuals feel the program is set-up the way it was intended to meet implementation.29 To assess effectiveness the survey will have questions asking about overall satisfaction with the program, the areas that the participant thinks is going well as well as areas that could improve better.29 To gage efficiency of whether the pros outweigh the cons of the program, the questions will ask if the trouble of transportation and performing the tiresome interventions is worth the benefits of hopefully meeting the goals of mobility, cognition, and quality of life as well as the benefits of being in a group community class for individuals alike.29 Cost-effectiveness will ask questions whether the cost is fair ($60 per participant) to help pay to rent out the building and provide the necessary tools to perform outcome measures (printing paper for PDQ-39 and MMSE and having pens/pencils to write with) and suggestions for improvement.29 Furthermore, it’s important to evaluate participation (via a check-in sheet at each session), resources being used wisely (is the dance studio with mirrors and support bars is beneficial or would a cheaper location be adequate as well as do the personnel and volunteers feel their time is being spent efficiently or do they feel their roles could be improved).29 Addressing all these areas in the satisfaction survey will help to assess if changes are needed both for current participants as well as for future ones to best enhance the program.

Overall, it is imperative that program evaluation occurs throughout the program to help assess and make needed adaptations to the program to best meet the goals of the program and adjust for the needs and desires of the participants and personnel helping. Utilizing this information will allow the program to continually improve and be able to provide optimal care to meet the outcomes and goals of the program.

1. **Conclusion**

Big Moves community program will be beneficial and meaningful for individuals with Parkinson’s Disease in Cary, NC as it will address key areas impacted by this disease to enhance overall well-being through evidence-based interventions and education regarding their chronic, progressive disease. Parkinson’s Disease has many adverse effects both physically, mentally, and psychosocially that can decrease their quality of life. This community program allows individuals with the same progressive disease to become a support network and work together toward the same goal of learning about their condition and how to help manage it despite its undoubtable progression. This program utilizes the Social Ecological Model by addressing the participant (intrapersonal) through the interventions, their interpersonal level through providing handouts to give to their friends and family, and even community level by enhancing their network of support. By impacting three levels in this model, there is greater likelihood of helping create change in the individual’s habits, such as exercise, to have a better likelihood of helping their disease when the program ends. Additionally, this program is led by licensed physical therapists who have experience working with individuals with this disease helping enhance confidence for those who partake. The high intensity, dual-task and amplitude interventions mixed with music and dance therapy as well as educational handouts this program provides aims to improve patients’ clinical symptoms and mobility while reducing cognitive decline to enhance health-related quality of life in the hope that participants will gain confidence in understanding and applying that knowledge to help slow the progression of this disease.

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