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ORIGINAL ARTICLE

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A Cost-Effective Physiotherapy and Allied Health Program to Improve Education, Independent Function, and Reduce Falls in Patients with Parkinson's Disease

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ABSTRACT

Background: Parkinson's is a degenerative neurological condition of increasing incidence globally. There are a broad range of motor and non-motor symptoms individually experienced. Falls can be common and can increase the risk of fractures with consequent, potential complications of a possible hospital admission. Early-stage education, promoting informed self-management including engagement in exercise, may reduce the associated consequences of reduced mobility, confidence and quality of life. This paper describes an inexpensive allied health led programme of exercise and education that aims to improve quality of life, reduce falls and promote self-managment. It promotes a proactive rather than reactive approach to Early Parkinson's care.

Methods: Ten volunteer patients with Parkinson's Disease were recruited into a ten-week allied health program combining education about the condition and a course of physiotherapy led exercise to improve mobility and reduce falls.

Results: Objective testing revealed an overall marked improvement in mobility and a reduced risk of falling. Developing knowledge and camaraderie between staff, patients, and relatives significantly improved the the patients's self-managment and improved mental health.

Conclusion: Activities of daily living can be significantly enhanced in Parkinson's Disease patients with an inexpensive allied health plan.

Keywords: Parkinson's Disease, Allied Health, Physiotherapy, Falls Risk, Mobility evaluation and improvement, Independence and self-confidence.

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INTRODUCTION

Parkinson's is the fastest-growing global neurodegenerative condition. Currently, 1 in 37 people will be diagnosed with PD in their lifetime. There are thought to be diagnosed cases in the UK, with an anticipated 20% increase in incidence by 2030 [1,2].

An increased tendency to fall in People with Parkinson's (PwP) has been known for at least two centuries, as described in James Parkinson's original essay on the shaking palsy [3]. The incidence of falls and fractures is twice as frequent in people with Parkinson's (PwP)compared with age matched controls; with consequent healthcare expenses from potential prolonged hospital admissions, orthopaedic surgery and rehabilitation.. Evidence shows that 25% of patients will fall within their diagnosis year [4, 5, 6].

Internationally, research supports the need for proactive and holistic assessment and treatment in the early stages of Parkinson's (7,8,9) The UK NICE guidelines for Parkinson's disease and European Physiotherapy Guideline for Parkinson's disease also advocate for early Multidisciplinary Team involvement (10,11). However, the increased incidence of Parkinson's diagnosis in the UK is not always matched by increased staffing to meet this demand. A point that was highlighted in the 2022 Parkinson's audit and is being addressed by Parkinson's UK pump-priming posts for Parkinson's nurses and Allied Health Professionals (AHPs). The consequence of this growing population is that patients often only meet AHPs at the point of perceived need. This can mean a key time for promoting and initiating exercise whilst in a stable phase may be lost.

A pilot was devised to provide a course of proactive exercise and education sessions for PwP and their loved ones which aimed to improve the quality of life and ability to live well with Parkinson's. People with Parkinson's were actively involved in every stage of the planning of this course. The vision was for every newly diagnosed PD patient to be referred at the point of diagnosis to attend a 10-week, course of exercise and education sessions. This concurs with the NICE guidelines supporting the recommendation that people with Parkinson's disease should be considered for referral to a physiotherapist with specialist knowledge of the condition soon after diagnosis. The program also follows the European Physiotherapy Guideline for Parkinson's Disease, promoting self-management, defined as *"an individual's ability to cope with symptoms, treatment, physical, psychosocial, and social consequences, and lifestyle changes to a chronic condition. It entails collaboratively helping patients and families acquire the knowledge, skills, and confidence to manage their chronic illnesses.* It was proposed that a patient would be referred to a ten-week course of once-a-week exercise and education sessions lasting two hours. Many of the exercises came from the Australian. PD Warrior® [12] programme with support and guidance from their team. The education sessions were provided mainly by local therapists and people involved in Parkinson's.

This paper describes a successful community-based (local leisure center) physiotherapy-driven program. It targeted education, balance, and depression, which reduced falls and potentially future hospital expenses and increased knowledge and self-management through education and support networks.

Demographics

This course was implemented by physiotherapists within locality therapies at St Mary's Hospital, Newport, the Isle of Wight (IOW) UK, with a population of circa 141,000. The prevalence of Parkinson's on the IOW is around four hundred patients, and at the time of the pilot, the annual incidence was estimated to be between 20-50 patients.

Previous management in the IOW NHS had been a referral from a general practitioner,

Parkinson's nurse or neurologist to physiotherapist, a process with often long waiting lists.

There was no specific course for people after diagnosis.

Pilot demographics:

Ten cases were enrolled in the pilot study in whom Parkinson's had been initially diagnosed between 2008 and 2022; all were in the early stages of H and Y stage 1 or 2 [13]. These patients were referred by a Parkinson's nurse, a Neurologist, or fellow AHPs, all aware of the pilot study. Three patients had experienced falls before the course. Contact with NHS therapists before the course were tabulated. Several people had not lived on IOW when they initially received their diagnosis, so the waiting times to be seen by AHP, though only a small cohort, were representative of not only IOW but national waiting times and/or referral processes. Only three out of ten received physiotherapy within their diagnosis year, and none received an occupational therapy, dietician, or psychology assessment or guidance within their first year or until the time of the course. One of the ten received a speech and language assessment within their first year.

METHODS

The pilot group was recruited between January and May 2022, and the pilot course started in June 2022 and ended in August 2022. A local leisure center was hired to provide a non-clinical space for education, exercise, and community networking for Parkinson's patients and their families. Patients were seen in a group setting rather than on a 1-1 basis to be cost-effective. The pilot group ran one afternoon a week for two hours for ten weeks. Initially, we placed education before the exercise session but then changed to exercise first as it was the majority preference.

Prior to the course, the author attended PD Warrior® Level 1 and 2 and then gained NHS funding to host PD Warrior® training on the IOW for therapists. PD Warrior® was designed in Australia in 2011 by Dr Melissa McConaghy and Lynn Tullock. The four pillars of PD Warrior® were concordant with and considered very important to the ethos of this course: neuroactive exercise, education, community, and behavioral change. The trust does not hold a license for PD Warrior® and therefore could not run the PD Warrior® program but was able to use the concepts of PD Warrior® within the Parkinson's exercise class, they provided alongside some other Parkinson's specific exercises and cognitive and vocal games.

Optimum staffing was considered to be physiotherapists and one assistant, one demonstrating the exercises, one providing individual feedback, and one safety spotting. Patients were encouraged to practice exercises at home and were given the appropriate equipment to take away.

Education sessions focused on the early stages of Parkinson's, empowering them with knowledge to promote self-care. Each educator was briefed on this, so as not to overwhelm the PwP; this was considered very important. The sessions were in an informal situation with tea and cakes and time for questions. Many lively discussions occurred! It was hoped that an environment would be created where PwP felt comfortable sharing their experiences, which happened initially and continued throughout the course.

The education sessions comprised of: a physiotherapy talk on the importance of exercise, occupational therapy, dietetics, speech and language therapy, the Parkinson's nurse service, medical management, talking therapies, Parkinson's UK local branch talk, and ongoing exercise opportunities. Patients were emailed resources from each session at the end of the programme to keep.

It was never intended to be solely Education and Exercise, but the hope was that friendships and support links would be made, all things that could not be "timetabled" in, but it was hoped that the atmosphere would be conducive to enable this.

Several outcome measures were used, as detailed in Table 1. It is worth noting that a questionnaire was devised with the assistance of each "educator" to assess the level of relevant of PwP in each area before the 10-week program and after.

RESULTS

Table 1: Outcome measures employed

Physical objectives
5 x STS / Mini Best Test - balance test / 10 bean test / 6MWT / 10MWT+ motor
Personalised goals
Individual SMART goals set with patients at the start of 10 weeks
Education
A questionnaire devised with all educators to look at the knowledge base before and after 10 weeks
ADL and QOL
PDQ39 – validated questionnaire looking at eight dimensions of daily living
Subjective
Feedback forms on each session and course as a whole/ Focus group led by patient experience

Results A Subjective:

All patients were reassessed within three weeks of finishing the course. Prior to this reassessment, at the end of the course a focus group was run by the trust patient engagement team. They reported the following assessment of the focus group: "Feedback was overwhelmingly positive, and the quality of life was significantly improved for participants, who felt very supported and cared for. The ability to engage and get support from other people with Parkinson's made a huge difference. They felt less isolated and abandoned. Mobility, fear of falling and confidence improved massively from the exercise classes, and there was very strong support for the group to continue. Some individual comments are recorded below:

1 Patient comments.

"My aqua aerobics teacher can notice I move better, and I am able to drive more confidently."

"I can now lather soap which I couldn't before."

"The benefits of networking with others who have Parkinson's is particularly useful in reducing a sense of isolation and facilitating the exchange of information. For example, through talking with another course participant I spoke with my GP and have now been prescribed a drug which I was not aware of to manage my sleep problems. The difference this has made to my life is huge."

"Having attended the course, I feel far more positive, informed and confident about living with Parkinson's."

"It has been weekly experience enthusiastically looked forward to and the energy generated has had a remarkable effect on our daily lives. Simple things like dressing and undressing are much easier thanks to some of the exercises, getting off a chair and getting out of bed once challenging is now not so."

Table 2: Personal timed goals

Patient	Goal	Achieved?
1	To be able to turn without feet sticking in 3/12	Yes, full marks in Mini Best turn and stop
2	To have more knowledge around PD 3/12	Yes – email to report this
3	To be able to turn each side in bed 3/12	Yes, achieved at halfway
4	Improved function of left arm 3/12	Variable, some days better than others
5	Improved confidence stepping backwards and reduced fear of falling backwards 3/12	Yes, confirmed in Mini Best. Now full marks in reactive postural control
6	To get around eighteen holes of golf 3/12	Up to sixteen from six feels will get further
7	To improve balance and general fitness 3/12	Now able to stop herself losing balance
8	To be able to rise from a chair without using hands 3/12	Greater ease STS from chair with no arms. Demonstrated in STS – now 10 seconds quicker
9	x	x
10	To stop tripping when walking 3/12	Yes, not tripping at all. Improved mini best test

(note patient nine attended via teams at the start and was not asked her goal on the first session)

Questionnaire:

Patients showed a greater understanding of different services, how to get referred, when to consider being referred and when they could self-refer. For example, it is possible to self-refer to talking therapies and with a high prevalence of anxiety and depression amongst PwP this is really significant. 90% before the course did not know they could self-refer. In terms of the importance of exercise before the course 50% said it was an important part of their life and after 90% said it was an important part of their life. We were keen to educate on the importance of neuro active exercise and before the course only 20% knew and understood about this concept and after 80% felt that they understood it.

B Objective data (note patient nine was away when the minibest test assessment was completed)

A Mini BESTest

The Mini-BESTest (MBT) is a clinical balance test of posture, balance, and gait that has shown high sensitivity in detecting balance impairments in PD. Of the four cardinal symptoms of PD (tremor, bradykinesia, rigidity, and postural instability), all but tremors are related to impaired balance control [14, 15].

All nine patients completing ten weeks improved, seven of them with an MCID (minimal clinically important difference) 4 or more.

The MBT initially placed six of nine patients, highlighted in red in the table, at increased risk of falls with a score of 21.5 or below, but only one remained a falls risk after ten weeks.

Table 3: Mini BEST table

Patient	Pre	Post	Better/Worse/Same	MCID
1	20	24	B	Y
2	24	27	B	N
3	9	25	B	Y
4	21	26	B	Y
5	19	27	B	Y
6	24	26	B	N
7	22	26	B	Y
8	20	25	B	Y
9	x	x	x	x
10	17	21	B	Y

B Five Times Sit to Stand Test (5XSTS)

This timed test is another simple but accurate test of function in PD [16,17].

Nine out of ten completed this test in less time on the retest, with six showing significant improvement (MCID 2.3). The other three improved sufficiently to complete 5XSTS within the age-matched norm time. Four of the ten were initially identified in an 'at risk falls category' taking over sixteen seconds. (Highlighted in red on the table) and only one after the program. The one that did not improve had a 0.03-second increase, which could be an inter-rater error. The overall average improvement was 4.89 seconds, therefore significant.

Table 4: 5XSTS Table

Patient	Pre- seconds	Post- seconds	Difference	MCID
1	20.00	10.86	9.14	Y
2	17.43	12.30	5.13	Y
3	11.05	10.40	0.65	N
4	8.00	7.78	0.22	N
5	14.00	8.81	5.19	Y
6	11.05	8.65	2.40	Y
7	15.57	16.00	plus 0.43	N
8	32.00	20.96	11.04	Y
9	16.00	10.50	5.50	Y
10	19.00	9.00	10.10	Y

C Six Minute Walk Test (6MWT)

Eight of the ten patients had an improved 6MWT at the end of the ten-week course. Of the two with a reduced 6MWT, one was not able to walk as fast after having had a recent total knee replacement since the first measure was taken and the other had back pain on the day of retesting.

Table 5: 6MWT

6MWT				
Patient	Pre- metres walked	Post- metres walked	Difference	MCID 82 m
1	410	360	50	N
2	400	470	70	N
3	0	330	330	Y
4	455	440	15	N
5	330	380	50	N
6	410	530	120	Y
7	300	350	50	N
8	300	340	40	N
9	345	380	35	N
10	400	410	10	N

Two of the ten had minimal clinically important differences (MCID) of >82 [18]. MCID are patient derived scores that reflect changes in a clinical intervention that are meaningful for the patient. Three of the ten participants were identified (highlighted in red in the table) at increased risk of falls before the sessions, recording a distance of less than the threshold of 320m. Following the programme, none of the participants where quantified in an increased risk of falls category [19].

Results

D 10 Metre Walk Test :10MWT

This performance measure used to assess walking speed over a short distance [20]. Patients who take longer than nine seconds to complete the 10MWT are deemed at an increased risk of falls.

Four were considered a falls risk both before and after the program, however, nine were at risk of falling when the 10MWT was combined with the motor task and this improved to only four after the programme.

Table 6: 10 10Meter Walk Test

10 Meter Walk Test and motor task, passing an object from hand to hand.

Patient	Pre- seconds	Post- seconds	Difference-seconds	Pre-steps	Post-steps	Difference-steps
1	8.00	8.00	0.00	x	x	x
2	7.84	7.00	0.84	14	14	0
4	8.00	13.00	plus 5	13	15	plus 2
5	8.53	7.73	0.80	18	15	3
6	10.08	6.13	3.95	15	12	3
7	10.78	9.70	1.08	17	17	0
8	9.00	9.40	plus 0.40	18	19	plus 1
9	8.84	8.80	0.04	16	16	0
10	9.30	9.75	plus 0.45	18	18	0

Table 7: 10MWT with motor task

Patient	Pre- seconds	Post- seconds	Difference-seconds	Pre-steps	Post-steps	Difference-steps
1	9.00	9.00	0.00	x	x	x
2	9.51	7.58	1.93	16	13	3
3	8.53	7.80	0.73	18	18	0
4	10.00	8.00	2.00	13	14	plus 1
5	9.00	7.31	1.69	18	16	2
6	10.08	6.13	3.95	15	12	3
7	11.49	9.97	1.52	19	17	2
8	12.00	11.00	1.00	21	20	1
9	16.89	8.53	8.36	20	16	4
10	18.00	9.25	8.75	17	18	plus 1

E Results: PDQ 39

The Parkinson's Disease Questionnaire (PDQ-39) is a patient-reported measure of health status and quality of life across eight dimensions of daily living mobility and fine motor control, ADL's, emotional wellbeing, stigma, social support, cognitive impairment, communication, and bodily discomfort. The daily mobility questions include washing, dressing, tying shoelaces, handwriting, and spilling drinks. It is the most frequently used though not universally supported disease-specific health status measure [22].

9/10 patients improved (one that did not felt that she may have scored herself incorrectly first time) A lower score signifies an improvement.

7/10 improved with a difference in MCID score of greater than 4.22.

Table 8: PDQ39

Patient	Pre	Post	Difference	MCID improved
1	25.00	15.00	10	Y
2	36.00	22.00	14	Y
3	15.40	15.80	plus 0.40	N
4	35.00	27.00	8	Y
5	24.00	5.50	18.5	Y
6	31.00	10.60	20.40	Y
7	9.00	8.50	0.5	N
8	37.00	25.90	11.1	Y
9	26.60	23.40	3.20	N
10	20.20	9.35	10.85	Y

F Ten beans test

The patient is required to move ten beans one at a time from a table surface to a cup on the table 30cm away as fast as possible while being timed. The task is performed on the dominant hand and repeated on the non-dominant hand.

Four participants improved with both hands, one remained the same, two were worse, and three were better with one hand and worse with the other. The retest was done in the heatwave, which may have stopped further improvement from being demonstrated. However, interestingly, PDQ39 questionnaire dimension 3 which relates to ADL's requiring fine motor control - washing, dressing, handwriting, etc - showed improvement that is MCID significant for 9/10 participants in this area.

Table 9: 10beans test

Patient	Pre score	Post score	Better/ worse/same
1	R 12 L 9	R 12 L 9	S
2	R 14.96 L 11.48	R 11.48 L 14.65	R B L W
3	R 14.61 L 13.71	R 12.41 L 10.35	B
4	R 14 L 18	R 10 L 15.21	B
5	R 14.44 L 12.36	R 17 L 14.30	W
6	R 15.34 L 13.18	R 12 L 14.15	R B L W
7	R 11.26 L 12.05	R 13.25 L 13.30	W
8	R 17 L 16	R 11.45 L 11.26	B
9	R 20.20 L 18.53	R 23 L 16.88	R W L B
10	R 10 L 17	R 10 L 13	B

G Golf

There was an anecdotal report from one of the pilot patients who was interested in the changes in his golf pre and post pilot and wished to share it. He was a golfer and recorded his speeds and distances electronically at a driving range.

Before the pilot commenced:

- Ball speeds recorded from a Tee shot = Between 95 and 105mph.
- Distance of shots = 130 to 160 yards.
- Highest ball speed recorded = 108mph.

After completion of the pilot course:

- Ball speeds recorded from a tee shot = Between 110 and 122mph.
- Distance of shots = 170 to 200 yards.
- Highest ball speed recorded = 125mph.

He reported "in achieving these improved levels of performance, nothing has changed over the past 3 months other than my attendance at the PD Pilot event. My medication has remained the same, and the frequency of my golf play and attendance at the driving range has also remained the same."

Summary of responses and reduction in falls risk

All patients understood the importance of regular exercise. Falls risk had been considerably reduced following the ten-week course. Prior to the program three of the patients had experienced a total of five falls. Following the course, the only one fall was reported..

Table 10: Tabular summary of falls risk per modality before and after the ten-week program

Test Modality	No at fall risk initially	No at falls risk after program
MiniBESTest	6	1
5XSTS	4	1
10MWT	4	4
6MWT	3	0

Table 11: Tabular summary of falls risk per patient per modality before and after the ten-week program

Patient number	Mini BESTest before	after	5 XSTS before	after	6 MWT before	after	10 MWT before	after
1	Y	N	Y	N	N	N	N	N
2	N	N	Y	N	N	N	N	N
3	Y	N	N	N	Y	N	N	N
4	Y	N	N	N	N	N	N	Y
5	Y	N	N	N	N	N	N	N
6	N	N	N	N	N	N	Y	N
7	N	N	N	N	Y	N	Y	Y
8	Y	N	Y	Y	Y	N	Y	Y
9	N	N	Y	N	N	N	N	N
10	Y	Y	Y	N	N	N	Y	Y

Every patient was deemed a falls risk on at least one test modality before the program. After the program six were not considered at risk of falls.

DISCUSSION

Results

1 Mobility and falls risk improvement

Following the programme, there was a significant reduction in falls risk within the group. The cost of another fall may have been significant both to the patient and financially for the trust, especially because PwP spend longer than average in hospital. There was a significant improvement in PDQ39 quality of life scale and improvement in knowledge of the condition as evidenced by our devised questionnaire [21].

2 Peer support and mental health

Clearly this is inextricably linked with the physical results. There was 100% attendance excluding sickness and planned holiday. It was clear the pilot group not only learnt a lot more about Parkinson's and what support is available following diagnosis, but they felt comfortable in the course and felt it was THEIR course. It was also clear watching the group that over the period of 10 weeks they really bonded.

It was encouraged at the beginning that a spouse/son/daughter/loved one attended as well. We noted that initially there were more loved ones in attendance regularly than at the end. When we asked about this the reply was that they felt comfortable to come alone. They had initially brought someone as a support but felt it was not needed. Though we saw this as a complement we also wanted to encourage a loved one to attend to benefit from the education. One of the daughters who attended all the way through felt that she and her mother could discuss the education sessions in the car on the way home and she could assist in remembering exercises.

The pilot participants and their loved ones formed a strong support network – often problem solving amongst themselves as well as educating us often on useful products, tips and tricks that they had found to work. Importantly all had fun – this was clear in the feedback from patients, loved ones and therapists!

It was decided that there should be an end of course party! One patient who plays croquet organised this event with her husband and the croquet became extremely competitive towards the end, reflecting increased physical ability and self-confidence! They also decided that they wanted to set up a WhatsApp group to continue meeting up, socialising and sharing.

Comments

This pilot showed that an allied health exercise and education program could be an important part of management of those newly diagnosed with Parkinson's.

A limitation of this study is the number of patients involved and for this pilot study, though all were in the early stages, not all were newly diagnosed. Also, it is of course a small cohort. As this was not intended to be a research study there was not a control group or independent assessors. It is also perhaps argued that testing in a clinic setting is not always representative of a patient's true state. This therefore possibly makes the inclusion of feedback, goals and

PDQ39 even more important. When test results correlate with subjective measures the result may be argued to be stronger.

Theoretical implications for the future

It was clear to all the health care professionals involved that having these groups in place on an on-going basis would enable, informed self-management and an awareness of when to seek assistance in a proactive way. It would also encourage exercise habits aiming to reduce falls risk. Both of these would then aim to reduce avoidable hospital admissions. Many of the pilot study patients planned future exercise classes with a number of them going together. Longitudinal data in relation to wellbeing and falls from the initial and future groups would be needed to provide stronger statistical supporting evidence.

Since the course, a business case was successfully submitted to the trust and to Parkinson's UK for an excellence grant for the courses to continue. Future additions have included a pilot talking therapies group 6-week course, a Cure Parkinson's talk, hand therapy, a drumming session and having a past participant volunteering as a lived experience patient on subsequent courses.

Acknowledgement

We would like to express thanks to PD Warrior® Dr Melissa McConaghy and Vicky Knight for their huge support, and training and to Sean for being the inspiration in setting this up. Also, the many health care workers who provided invaluable help for this project particularly Christine Huston in Nottingham and on the IOW: Shane Innes, Dr Manson, Cathy Frost Jo Lawrence Dr Caroline Linton, Dr Stuart Linton and also, but also Sue, Rob, Ron, Vanessa Caroline, Stuart, Occupational Therapy, Speech and Language Therapy, Dieticians, PD Service, PDUK IOW, IAPT, exercise professionals. And the invaluable ongoing support and advice from the pilot participants.

This paper is dedicated to the late Surgeon Captain J.D. Stride, FRCP, father and grandfather and mentor of the authors, a committed and compassionate Naval Officer and Physician with a special interest in Parkinson's Disease.

Ethics, Funding, Conflict of interest

The program was a quality improvement project and Rebecca Verling worked with the QI lead and her deputy with full clinical and administrative approval. All patients signed a form of informed consent. A 'safety spotter' was present during exercise sessions to ensure participants were not stressed or distressed.

The only funding required was a minimum sum for hire of a hall which was paid out of the Allied Health Department petty cash. There were no conflict-of-interest issues.

Credit Author Statement

Rebecca Verling is a physiotherapist with an interest in Parkinson's and is the communicating author. The pilot was subsequently presented at a regional Parkinson's forum in Power Point format.

Peter Stride is a retired specialist physician and developed the Power Point data into a written manuscript format for publication, adding some additional information and refences.

Contribution of the paper

- This paper describes the application of recently published guidelines in the treatment and assessment of patients with Parkinson's Disease in clinical practice.
- Physiotherapy and other Allied health techniques were utilised to measure and improve mobility and reduce falls risk.
- This inexpensive and reproduceable protocol supplements medication and surgery in significantly improving patients' mobility, independence, self-confidence and knowledge of the disease.

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