Comparison of patient rated treatment response with measured improvement in Parkinson’s disease

Matthew B Davidson, David J M McGhee, Carl E Counsell

ABSTRACT
Background A marked response to dopamine replacement therapy is important in supporting a diagnosis of idiopathic Parkinson’s disease (PD). The aim of the study was to compare PD patients’ subjective rating of improvement with measured improvement on a number of scales.

Methods People with clinically defined PD were identified from a prospective long term follow-up study of incident parkinsonian patients. Changes in the Unified Parkinson’s Disease Rating Scale (UPDRS) (activities of daily living and motor subsections), timed tests and Parkinson’s Disease Questionnaire, full version, between assessments immediately before starting adequate dopamine replacement and the two subsequent follow-up assessments (mean 6 and 12 months after baseline) were calculated. These were compared with the patients’ own subjective ratings of improvement (nil, slight, moderate, good, excellent).

Results 133 patients were included (mean age 71 years, 56% men). Thirty-eight patients were treated with a dopamine agonist and 95 with levodopa (median levodopa equivalent dose 300 mg). Most patients showed improvements in their measured scores but there was no statistically significant association between these scores and the patient subjective response, except for the motor UPDRS at the first follow-up. A third of those who showed no improvement in their motor UPDRS at the first follow-up rated their improvement as moderate or better, while 29% of those whose motor UPDRS improved by over 50% said they had no or slight improvement.

Conclusion PD patients’ subjective ratings of their degree of improvement often do not accurately reflect the degree of objective change in parkinsonian impairment or disability. Clinicians should record a simple measure of motor impairment before and after treatment to assess treatment response more accurately.

INTRODUCTION
In both clinical practice and formal research criteria,1–3 one of the major supportive criteria used to make a diagnosis of idiopathic Parkinson’s disease (PD), as opposed to another parkinsonian syndrome, is a marked improvement in the motor features with adequate dopaminergic replacement therapy. Response to treatment is also a key component in subsequent dose alteration. This raises the issue of how response to therapy is assessed.

In clinical practice, one of the major ways of accessing treatment response is by asking the patient to subjectively rate their improvement. However, it can also be measured objectively by performing motor tasks, such as timed tests, or completing an assessment of motor impairment such as the Unified Parkinson’s Disease Rating Scale (UPDRS).4 To our knowledge, no studies have assessed how well the subjective reporting of improvement by patients correlates with objectively measured improvement.

The aim of this study was, therefore, to compare PD patients’ subjective assessment of their response to treatment with objective improvement, in order to assess the usefulness of the subjective response when clinicians are deciding whether a patient has improved significantly with treatment.

METHODS
The Parkinsonism Incidence in North-East Scotland (PINE) study aimed to measure the incidence and prognosis of parkinsonism, including PD, in Aberdeen and the surrounding area. The original pilot study2 was extended to recruit a total of 577 patients with possible or probable parkinsonism (defined as two or more of bradykinesia, rest tremor, rigidity, postural instability) who were offered lifelong follow-up. The PINE study was conducted with the adequate understanding and written consent of the patients involved. The research was approved by the North of Scotland Research Ethics Committee.

Patients could consent to simple clinical follow-up, including yearly assessment of the motor part of the UPDRS and Mini-Mental State Examination (MMSE),4 or more detailed follow-up, including yearly assessment of the full UPDRS as well as timed tests of walking and upper limb function (tapping with either hand between two counters), the 59 item Parkinson’s Disease Questionnaire (PDQ-59),8 the Mini-Mental Parkinson’s (MMP)7 and the 15 item Geriatric Depression Scale (GDS-15).10

At each follow-up appointment the most likely clinical diagnosis of the cause of their parkinsonism was made by a movement disorder specialist (eg, PD, dementia with Lewy bodies, vascular parkinsonism, a Parkinson-plus syndrome) using all the available information, including the clinical features, response to treatment, motor complications and imaging. The UK Parkinson’s Disease Society Brain Bank criteria1 were used to guide a clinical diagnosis of PD but not rigorously enforced, partly because those with early PD often cannot fulfil three supportive criteria as they have had insufficient follow-up. All patients had to meet the definition for parkinsonism and not have any major exclusion criteria (repeated strokes with stepwise decline, cerebellar features, early severe autonomic involvement, supranuclear gaze palsy, cerebral atrophy, dementia, dementia with Lewy bodies,vascular parkinsonism, a Parkinson-plus syndrome, a previous clinical diagnosis of the cause of their parkinsonism).

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early dementia or apraxia) but a family history, use of neuroleptics (if an FP-CIT scan was abnormal) and an isolated extensor plantar were not regarded as absolute exclusion criteria.

Patients could be seen for an interim appointment between their yearly assessments if they or their general practitioner felt they needed treatment, at which point they had a motor UPDRS assessment. Factors including clinical presentation (tremor less likely to respond than bradykinesia), the impact of symptoms on the patient’s lifestyle and patient preference were taken into consideration, but no specific scores were used to guide initiation of treatment. There was no standard frontline dopaminergic medication: the treatment choice was made after discussion of the advantages and disadvantages of each option with the patient.

Once started on treatment, patients were seen again after approximately 4–6 months to assess their response to treatment, both subjectively and by repeating the motor UPDRS (and the timed tests and PDQ-39 in those who had consented to more detailed follow-up if the visit coincided with a yearly assessment). Given that none of the patients were fluctuating, all treatment scores were in the ‘on’ state. Post-treatment scores were made without knowledge of pretreatment scores and were usually made by the same study doctor. The subjective response was measured on a 5 point scale by simply asking the patient to rate whether they had experienced no response to treatment, a slight response (<25% improvement), a moderate response (25–49% improvement), a good response (50–75% improvement) or an excellent response (>75% improvement). Similar subjective scales have been used in previous studies.11

For this analysis, patients were included if all four of the following conditions were met: (i) their latest or final (if they had died) clinical diagnosis was idiopathic PD; (ii) they had a pretreatment (baseline) assessment of their motor UPDRS from either a yearly or interim visit no more than 6 months before starting treatment—any longer and it was felt that disease progression may have significantly altered their baseline scores; (iii) they had a follow-up appointment to assess the effectiveness of treatment at least 3 months after starting treatment, to allow time for a treatment effect to have developed, but no more than 12 months after their pretreatment assessment; and (iv) they were on adequate treatment at follow-up, which was defined as at least 3 months of L-dopa or a dopamine agonist and 95 (71%) were on L-dopa. Twenty-seven of the included patients did not contribute data to the second follow-up after starting treatment because they had not had a second follow-up (death or not yet due), had stopped/changed treatment or their second follow-up was more than 18 months after their pretreatment appointment.

Baseline characteristics
Table 1 details the baseline characteristics for patients who were commenced on either a dopamine agonist or L-dopa. As expected, those starting L-dopa had significantly worse disease at baseline (in terms of motor UPDRS scores and timed walks) and were older than those commencing a dopamine agonist.

Treatment analysis
Mean time between the pretreatment visit and FU1 was 6.1 months (SD 2.1), and baseline and FU2 was 12.4 months (SD 2.2).

Comparison between baseline and follow-up scores
As can be seen in table 2, a general improvement in most test scores was seen after treatment at FU1 (except for the PDQ-39). This improvement was sustained at FU2. The differences in improvement between those on L-dopa and those on a dopamine agonist were not significant, except for a greater improvement with L-dopa in timed walks at FU1 (p=0.002, Mann–Whitney test), motor UPDRS at FU1 (p=0.049) and motor UPDRS at FU2 (p=0.007) (data not shown).

Changes in scores compared with subjective responses
The changes in the measured test scores stratified by the patient’s subjective response score at both FU1 and FU2 are shown in table 3. Some of the groups had very small numbers of patients. For most measures, the median scores showed improvement across all subjective response groups although the differences from pretreatment were often small. While the
improvement was always greatest in those who rated themselves >75% improved, the only statistically significant association between changes in a measured score and subjective treatment response was for the motor UPDRS at FU1 (p=0.004). Even here, the median change in motor UPDRS score from baseline to FU1 for those reporting no subjective improvement in their parkinsonism was −3.0 (IQR −10.0 to 3.0) suggesting that, despite patients’ subjective views, the motor impairment had actually improved in most. Stratification of measured test scores by subjective response was repeated for both the l-dopa treated and dopamine agonist treated patients separately, but unfortunately the numbers in many groups after stratification were too small to allow a meaningful analysis.

The subjective response was also analysed according to the percentage change in the patients’ motor UPDRS from pretreatment to FU1. The percentage UPDRS improvement was categorised as worse or no change, >0–25% improvement, >25–50% improvement and >50% improvement (figure 1). There was a significant trend for more patients to rate themselves as significantly better (good or excellent) with increasing percentage improvement at FU1. For those with >25% improvement in the motor UPDRS, there was no significant difference in the percentage of patients with a GDS-15 score of ≥5 between these groups (12/42, 28.6% vs 5/17, 29.4%; p=1.000). Similarly, the impact of possible coexistent cognitive impairment, defined as either a MMSE of ≤24/30 or a MMP of ≤27/32, on patients’ subjective responses at FU1 was analysed. One hundred and thirty-two patients had a MMSE score and 109 a MMP score, which were taken from the visit closest to FU1. For those with >25% improvement in the motor UPDRS, there was no significant difference in the percentage of patients with cognitive impairment or self-rated measures of disability or quality of life.

### Table 1 Baseline characteristics prior to commencing treatment

<table>
<thead>
<tr>
<th>All patients (n = 133)</th>
<th>Treated with agonist (n = 38)</th>
<th>Treated with l-dopa (n = 95)</th>
<th>Agonist vs l-dopa (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at diagnosis (years) (mean (SD))</td>
<td>70.7 (10.5)</td>
<td>59.2 (9.5)</td>
<td>75.2 (6.6)</td>
</tr>
<tr>
<td>Male gender (%)</td>
<td>74 (55.6)</td>
<td>18 (47.4)</td>
<td>56 (58.9)</td>
</tr>
<tr>
<td>UPDRS part (I) (n=101)</td>
<td>1.0 (0.0 to 3.0)</td>
<td>1.0 (0.0 to 3.0)</td>
<td>2.0 (0.5 to 3.0)</td>
</tr>
<tr>
<td>UPDRS part (II) (n=101)</td>
<td>12.0 (8.0 to 16.0)</td>
<td>10.0 (6.3 to 13.8)</td>
<td>13.0 (9.0 to 16.0)</td>
</tr>
<tr>
<td>UPDRS part (III) (n=133)</td>
<td>30.0 (24.0 to 37.5)</td>
<td>24.0 (19.0 to 30.0)</td>
<td>32.0 (28.0 to 39.0)</td>
</tr>
<tr>
<td>PDQ-39 (n=94)</td>
<td>19.0 (11.3 to 32.0)</td>
<td>15.3 (7.6 to 29.7)</td>
<td>19.5 (12.5 to 33.1)</td>
</tr>
<tr>
<td>Timed walk (s) (n=113)</td>
<td>20.0 (16.0 to 26.5)</td>
<td>15.0 (13.0 to 18.0)</td>
<td>23.0 (18.3 to 30.0)</td>
</tr>
<tr>
<td>Hand taps (n=113)</td>
<td>24.0 (19.0 to 30.0)</td>
<td>25.5 (22.0 to 32.0)</td>
<td>24.0 (19.0 to 30.0)</td>
</tr>
<tr>
<td>LEDD at FU1</td>
<td>300 (300 to 300)</td>
<td>280 (195 to 365)</td>
<td>300 (300 to 300)</td>
</tr>
<tr>
<td>LEDD at FU2</td>
<td>300 (300 to 450)</td>
<td>380 (280 to 480)</td>
<td>300 (300 to 450)</td>
</tr>
</tbody>
</table>

Data are median (IQR) unless otherwise stated. Comparisons between patients treated with a dopamine agonist and those treated with l-dopa were made using the Mann–Whitney test, unless otherwise stated. *Continuity corrected χ² test.

### Table 2 Change in scores from pretreatment to follow-up appointments 1 and 2 in all patients

<table>
<thead>
<tr>
<th>FU1 (mean 6.1 months)</th>
<th>FU2 (mean 12.4 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>Change</td>
</tr>
<tr>
<td>UPDRS (III)*</td>
<td>24</td>
</tr>
<tr>
<td>UPDRS (III)</td>
<td>133</td>
</tr>
<tr>
<td>PDQ-39*</td>
<td>23</td>
</tr>
<tr>
<td>Timed walks*</td>
<td>74</td>
</tr>
<tr>
<td>Hand taps†</td>
<td>63</td>
</tr>
</tbody>
</table>

Data are mean (SD) except for timed walks which are presented as median (IQR). *Negative value indicates improvement over time. †Positive value indicates improvement over time.

DISCUSSION

This study found a poor association between the degree of patient reported subjective improvement after commencing treatment and improvements in objective measures of motor impairment or self-rated measures of disability or quality of life. Only the motor UPDRS had a significant association with patient rated improvement, but even this was limited: the upper limit of the IQR for those who subjectively reported no or slight improvement at the first follow-up was minus 10 points, implying that 25% of patients in these groups improved by more
## Table 3: Median changes in individual test scores for each subjective response group

<table>
<thead>
<tr>
<th>Follow-up 1</th>
<th>Follow-up 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>No improvement (n = 22)</td>
<td>No improvement (n = 13)</td>
</tr>
<tr>
<td>&lt;25% improvement (n = 27)</td>
<td>&lt;25% improvement (n = 15)</td>
</tr>
<tr>
<td>25–49% improvement (n = 33)</td>
<td>25–49% improvement (n = 24)</td>
</tr>
<tr>
<td>50–75% improvement (n = 42)</td>
<td>50–75% improvement (n = 45)</td>
</tr>
<tr>
<td>&gt;75% improvement (n = 9)</td>
<td>&gt;75% improvement (n = 9)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test</th>
<th>No improvement</th>
<th>&lt;25% improvement</th>
<th>25–49% improvement</th>
<th>50–75% improvement</th>
<th>&gt;75% improvement</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPDRS (II)*</td>
<td>-3.0</td>
<td>(-10.0 to 1.5)</td>
<td>(-1.0 to -1.0)</td>
<td>(-4.3 to 2.5)</td>
<td>(-8.0 to -0.3)</td>
<td>-6.0</td>
</tr>
<tr>
<td>UPDRS (III)*</td>
<td>-3.0</td>
<td>(-10.0 to 3.0)</td>
<td>(-10.0 to 1.0)</td>
<td>(-15.3 to -4.0)</td>
<td>(-19.5 to -8.0)</td>
<td>0.004</td>
</tr>
<tr>
<td>PDQ39*</td>
<td>3.7</td>
<td>8.7</td>
<td>3.9</td>
<td>1.0</td>
<td>0</td>
<td>0.891</td>
</tr>
<tr>
<td>Timed walks*</td>
<td>2.0</td>
<td>(-5.0 to 2.0)</td>
<td>(-4.0 to 1.5)</td>
<td>(-6.0 to 1.0)</td>
<td>(-6.55 to -0.3)</td>
<td>0.375</td>
</tr>
<tr>
<td>Worst taps†</td>
<td>1.0</td>
<td>(-3.0 to 1.5)</td>
<td>(1.3 to 6.8)</td>
<td>(-3.0 to 6.5)</td>
<td>(0.5 to 7.5)</td>
<td>(1.5 to 13.8)</td>
</tr>
</tbody>
</table>

Data are median (IQR). *Negative value indicates improvement over time. †Positive value indicates improvement over time.

PDQ-39, Parkinson’s Disease Questionnaire, full version; UPDRS (II) and (III), Unified Parkinson’s Disease Rating Scale, activities of daily living and motor subsections, respectively.
were over 100 patients. The lack of standardised timing for follow-up appointments and the variation in objective measures used at each follow-up is another possible criticism. This simply reflects the real life nature of this prospective incidence study in which normal clinical care was provided to the participants as well as collecting research data. We used a conservative definition of adequate treatment but this probably gave a greater spectrum of objective improvement allowing us to examine for associations with subjective responses across a wider range of UPDRS change and the median LEDD at FU1 were adequate (table 1). Confounding of measured improvements by disease progression could also be a limitation of this study but is unlikely to be a major problem, especially at the first follow-up visit. We did not specifically collect a carer’s view of the response to treatment but we are aware that sometimes this did influence the patient’s response. Anecdotally, this was usually to highlight a better response than the patient initially suggested. When this happened we recorded the final ‘consensus’ view of the patient and carer.

Our use of an expert clinical diagnosis of PD guided by research criteria, rather than rigorous application of formal research criteria, reflected the real life nature of our study and the fact that in early disease some of the criteria are not applicable (e.g., the presence of motor complications). Moreover, expert clinical diagnosis has a similar positive predictive value as research criteria, rather than rigorous application of formal research criteria, as well as collecting research data. We used a conservative definition of adequate treatment but this probably gave a greater spectrum of objective improvement allowing us to examine for associations with subjective responses across a wider range of UPDRS change and the median LEDD at FU1 were adequate (table 1). Confounding of measured improvements by disease progression could also be a limitation of this study but is unlikely to be a major problem, especially at the first follow-up visit. We did not specifically collect a carer’s view of the response to treatment but we are aware that sometimes this did influence the patient’s response. Anecdotally, this was usually to highlight a better response than the patient initially suggested. When this happened we recorded the final ‘consensus’ view of the patient and carer.

In conclusion, in many patients the subjective rating of their degree of improvement with dopamine replacement therapy is not a reliable measure of objective improvement and could mislead clinicians if used as the sole source of information about treatment response. We recommend that in routine clinical practice, a patient’s subjective response is complemented by an objective measure, such as the motor UPDRS or a brief simplified version which could be used in a short follow-up clinic. In addition, it may be appropriate to modify research criteria for PD to define more precisely what is meant by a good response to treatment and how this should be measured.

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**Contributors** MBD undertook the statistical analysis and interpretation of the data, and drafted and revised the manuscript. DJMM undertook the statistical analysis and interpretation of the data, and drafted and revised the manuscript. He was also involved in acquisition of the data through the ongoing Parkinsonism Incidence in North-East Scotland (PINE) study, CEC devised the PINE study, and produced the idea for this manuscript. He revised the manuscript and provided overall supervision for this work. He obtained funding for the PINE study and was involved in acquisition of the data.

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**Competing interests** None.

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**Data sharing statement** The authors are open to discussion with interested parties regarding using data from the ongoing PINE study.

**REFERENCES**

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