

Preliminary Validation and Responsiveness of the NMSS-OFF/ON Scale for Rapid Assessment of Non-Motor Fluctuations in Parkinson's Disease

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Abstract

Non-motor fluctuations (NMF) are clinically relevant in Parkinson's disease (PD), but brief instruments capable of repeatedly quantifying symptom severity during acute OFF-to-ON transitions are limited. We performed a preliminary psychometric evaluation of the 10-item NMSS-OFF/ON scale, a clinician-rated instrument developed within the prospective multicenter INLEVO-LIFE PD study. Each symptom is rated from 0 (none) to 4 (very severe), yielding a total score of 0–40. Internal consistency, item characteristics, construct validity, known-groups validity, exploratory discrimination, and responsiveness were examined. Thirty-five participants had complete OFF-state item data and 34 had complete serial OFF/30/60/90-min assessments. OFF-state internal consistency was good (Cronbach α = 0.825; bootstrap 95% CI 0.678–0.890). The total score correlated strongly with MDS-NMS total (Spearman ρ = 0.689) and MDS-NMS NMF indices (ρ = 0.719–0.768), and moderately with PDQ-39 Summary Index (ρ = 0.599), while its association with UPDRS-III OFF was weak and non-significant (ρ = 0.239). Participants classified as having NMF by MDS-NMS had higher scores than those without NMF (7.26 vs 1.56; p = 0.00081). Exploratory ROC analysis yielded AUC = 0.886. NMSS-OFF/ON scores decreased markedly following treatment, from 6.65 ± 6.53 in the OFF state to 2.09 ± 3.53 , 1.91 ± 3.25 , and 2.71 ± 5.31 at 30, 60, and 90 min, respectively (Friedman p < 0.001), with large standardized response means. These findings provide preliminary evidence of internal consistency, construct validity, known-groups validity, and strong responsiveness. Larger independent studies are required to establish structural validity, reproducibility, interpretability, and clinically meaningful change thresholds.

Introduction

Non-motor symptoms (NMS) are integral to Parkinson's disease (PD) and contribute substantially to disability and impaired quality of life (Armstrong and Okun 2020; Chaudhuri et al. 2006; Martinez-Martin et al. 2011; Martinez-Martin et al. 2007). In patients with motor complications, many NMS fluctuate according to dopaminergic state, generating non-motor fluctuations (NMF) that may include anxiety, low mood, fatigue, cognitive slowing, pain, autonomic symptoms, and other manifestations (Witjas et al. 2002; Storch et al. 2013; Franke and Storch 2017; Boura et al. 2025). NMF are frequent, clinically important, and may not be temporally congruent with motor fluctuations (Witjas et al. 2002; Storch et al. 2013; Franke and Storch 2017; Boura et al. 2025; Kakimoto et al. 2023; Regensburger et al. 2026).

Several instruments have improved the systematic assessment of NMS and NMF. The Movement Disorder Society Non-Motor Rating Scale (MDS-NMS) provides a broad assessment of NMS burden and includes a dedicated NMF subscale with established reliability and validity (Martinez-Martin et al. 2019; Chaudhuri et al. 2020; Cubo et al. 2023). The Non-Motor Fluctuation Assessment questionnaire (NoMoFA) was specifically developed and validated to characterize NMF, with subsequent independent validation studies supporting its clinimetric performance (Kleiner et al. 2021; Balestrino et al. 2025). Other approaches, including ON/OFF-specific evaluations and symptom-focused instruments, have further emphasized the value of measuring the non-motor component of fluctuating PD directly rather than inferring it from motor state (Storch et al. 2015; Faggianelli et al. 2024; Donzuso et al. 2024).

However, instruments designed for comprehensive characterization are not necessarily optimized for repeated measurements over short intervals during an acute OFF-to-ON transition. A brief state-specific measure may be useful in levodopa challenge paradigms, rescue-treatment studies, and clinical settings in which symptom severity must be captured repeatedly within minutes. In the prospective INLEVO-LIFE PD study, a 10-item clinician-rated instrument (NMSS-OFF/ON) was used to quantify common OFF-related NMS immediately before and after inhaled levodopa (Santos García et al. 2026a). A subsequent post hoc analysis of the same cohort, suggested that motor and non-motor responses may follow partially dissociated temporal trajectories (Santos García et al. 2026b). Before broader use, the measurement properties of this study-specific instrument require explicit evaluation.

The aim of the present study was therefore to perform a preliminary psychometric evaluation of the NMSS-OFF/ON scale. We assessed data completeness, score distribution and floor/ceiling effects, internal consistency, corrected item-total associations, construct validity against established clinical measures, known-groups validity according to MDS-NMS-defined NMF, exploratory discriminative performance, and responsiveness to acute dopaminergic treatment. Because of the modest sample size and the absence of a stable retest condition, structural validity, test-retest reliability, and minimal clinically important difference were not considered confirmatory objectives.

Methods

Study design and participants

This was a secondary psychometric analysis of the prospective, multicenter, open-label INLEVO-LIFE PD study conducted at five centers in Spain. The parent study enrolled 40 people with PD receiving inhaled levodopa for OFF episodes and followed them for approximately 12 weeks. Full eligibility criteria, study procedures, treatment exposure, and primary clinical outcomes have been reported previously (Santos García et al. 2026a). The present analysis used the de-identified study database. Thirty-five participants had complete data for all 10 NMSS-OFF/ON items in the OFF state at the week-12 acute assessment, and 34 had complete item data at OFF, 30, 60, and 90 min.

NMSS-OFF/ON scale

The NMSS-OFF/ON is a study-specific clinician-rated measure designed to capture the severity of 10 NMS commonly associated with OFF episodes: pain, bad mood, anxiety, fatigue, dizziness, mind dullness, akathisia, dysphagia, bladder urgency, and sweating. Each item is scored at the time of assessment on a five-category ordinal scale: 0=none, 1=mild, 2=moderate, 3=severe, and 4=very severe. The total score is the unweighted sum of all items (range 0–40), with higher scores indicating greater acute NMS burden. The full item wording and response anchors are provided in Supplementary Table S1.

Comparator measures and hypotheses

Construct validity was evaluated using hypotheses defined for the present secondary analysis before examining the correlation results based on the expected relationships between current non-motor OFF burden and established clinical measures. We hypothesized that the OFF-state NMSS-OFF/ON total score would show: (1) strong positive correlations (Spearman $\rho \geq 0.50$) with the MDS-NMS total score and with the MDS-NMS non-motor fluctuation indices (NMF Change, NMF Time, and NMF Change $\times$ Time); (2) a moderate or stronger positive correlation ($\rho \geq 0.30$) with the PDQ-39 Summary Index, reflecting the impact of non-motor burden on health-related quality of life; and (3) weaker correlations ($\rho < 0.50$) with predominantly motor measures, including UPDRS-III in the OFF state and UPDRS-IV. Known-groups validity was additionally evaluated using the prespecified hypothesis that patients classified as having NMF according to the MDS-NMS were expected to have higher OFF-state NMSS-OFF/ON scores than those without NMF. The MDS-NMS has demonstrated validity and reliability internationally and in Spanish-speaking populations (Martinez-Martin et al. 2019; Chaudhuri et al. 2020; Cubo et al. 2023).

Psychometric and statistical analyses

The analysis was informed by established measurement-property terminology and contemporary COSMIN reporting principles (Mokkink et al. 2010a; Mokkink et al. 2010b; Terwee et al. 2007; Terwee et al. 2018; Gagnier et al. 2025). Descriptive analyses included missingness, mean, standard deviation (SD), median, interquartile range, and the proportion scoring the minimum and maximum category for each item. Item-level floor or ceiling effects were considered notable when a large proportion of participants occupied an extreme category; these findings were interpreted descriptively given the state-specific purpose of the scale.

Internal consistency was quantified with Cronbach's α for the 10-item OFF-state scale, with a nonparametric bootstrap 95% confidence interval. Standardized α , corrected item-total Spearman correlations, and α if each item was deleted were also examined. Because internal consistency does not establish unidimensionality and the available sample was inadequate for robust factor analysis, no confirmatory factor analysis was performed (Mokkink et al. 2010a; Mokkink et al. 2010b; Terwee et al. 2007; Terwee et al. 2018; Gagnier et al. 2025).

Construct validity was assessed using Spearman correlations between the OFF-state NMSS-OFF/ON total and MDS-NMS total, MDS-NMS NMF Change, NMF Time and Change $\times$ Time indices, PDQ-39 Summary Index, UPDRS-III OFF, UPDRS-IV total, and patient- and neurologist-rated Clinical Global Impression of Improvement (CGI-I), as available. Known-groups differences were assessed with the Mann–Whitney test. Exploratory receiver operating characteristic (ROC) analysis evaluated discrimination of MDS-NMS-defined NMF; the area under the curve (AUC) and an exploratory cut-point were reported for hypothesis generation only.

Responsiveness was evaluated among participants with complete OFF/30/60/90-min assessments after inhaled levodopa. Overall temporal change was tested with the Friedman test. Standardized

response means (SRM; mean within-person change divided by the SD of change) were calculated for OFF-to-30, OFF-to-60, and OFF-to-90 min changes. Individual item trajectories were tested using Friedman tests with Holm adjustment across the 10 item-level tests. Two-sided $p < 0.05$ was considered statistically significant. Analyses were exploratory and no formal minimal clinically important difference (MCID) was assumed for this unvalidated instrument.

Results

Score distribution and item characteristics

Thirty-five participants had complete OFF-state NMSS-OFF/ON data. The mean total score was 6.83 ± 6.52 and the median was 6.0 (IQR 1.5–10.0). Item means ranged from 0.14 for dysphagia to 1.29 for fatigue (Table 1). Marked floor effects were observed for several infrequent symptoms, particularly dysphagia (91.4% scoring 0), bladder urgency (82.9%), and akathisia (77.1%). Ceiling effects were minimal: only pain, bad mood, and anxiety had any participants at the maximum category, each 2.9%.

Internal consistency

Cronbach's α for the 10-item OFF-state scale was 0.825 (bootstrap 95% CI 0.678–0.890), and standardized α was 0.810. Corrected item-total correlations were highest for bad mood ($p = 0.700$), fatigue ($p = 0.653$), mind dullness ($p = 0.621$), anxiety ($p = 0.530$), and sweating ($p = 0.525$). Lower correlations were observed for dysphagia ($p = 0.249$), dizziness ($p = 0.280$), and akathisia ($p = 0.303$). Deleting any single item did not materially improve internal consistency; the highest α -if-deleted values were 0.831 after removal of dysphagia and 0.832 after removal of bladder urgency (Table 1). Internal consistency at the post-treatment assessments is presented in Supplementary Table S2.

Construct and known-groups validity

The OFF-state NMSS-OFF/ON total score showed strong positive correlations with MDS-NMS total ($p = 0.689$, $p = 0.000007$), NMF Change ($p = 0.768$, $p < 0.000001$), NMF Time ($p = 0.754$, $p = 0.000001$), and NMF Change $\times$ Time ($p = 0.719$, $p = 0.000004$). The association with PDQ-39 Summary Index was moderate-to-strong ($p = 0.599$, $p = 0.000184$). In contrast, the correlation with UPDRS-III OFF was weak and non-significant ($p = 0.239$, $p = 0.167$), supporting the hypothesized distinction between non-motor and motor burden (Table 2). The hypothesis-by-hypothesis comparison is presented in Supplementary Table S3.

Participants classified as having NMF by the MDS-NMS had substantially higher NMSS-OFF/ON OFF scores than participants without NMF (mean 7.26 vs 1.56; Mann–Whitney $p = 0.00081$). In exploratory ROC analysis, the NMSS-OFF/ON total discriminated MDS-NMS-defined NMF with an AUC of 0.886 (bootstrap 95% CI 0.667–1.000). A threshold of ≥ 3 yielded sensitivity of 82.6% and specificity of 88.9%;

because of the small sample and use of a related non-motor comparator, this cut-point should not be considered a validated diagnostic threshold.

All eight hypotheses specified for this secondary analysis were supported. The four hypotheses concerning MDS-NMS/NMF measures met the prespecified threshold for strong correlations ($\rho=0.689-0.768$), the PDQ-39 association exceeded the threshold for a moderate correlation ($\rho=0.599$), both predominantly motor measures showed the expected weaker associations (UPDRS-III OFF, $\rho=0.239$; UPDRS-IV, $\rho=0.294$), and the known-groups comparison was in the hypothesized direction (7.26 vs 1.56; $p=0.00081$).

Responsiveness

Thirty-four participants had complete repeated assessments. The NMSS-OFF/ON total decreased from 6.65 ± 6.53 in OFF to 2.09 ± 3.53 at 30 min, 1.91 ± 3.25 at 60 min, and 2.71 ± 5.31 at 90 min (Friedman $\chi^2=56.13$, $p=3.93\times10^{-12}$; Table 3 and Figure 1). SRMs for score reduction from OFF were 1.17 at 30 min, 1.13 at 60 min, and 0.88 at 90 min, indicating large standardized change in this treatment-responsive setting.

At item level, fatigue, bad mood, mind dullness, sweating, anxiety, and dizziness retained significant temporal effects after Holm correction. Pain showed a nominal temporal effect but did not remain significant after multiplicity adjustment, while akathisia, dysphagia, and bladder urgency were not significant after correction (Table 3). The item-level trajectories are illustrated in Figure 2.

Discussion

This preliminary psychometric study provides evidence that the 10-item NMSS-OFF/ON may be a useful brief measure for repeated assessment of acute non-motor burden during OFF-to-ON transitions in PD. Four findings are particularly relevant. First, internal consistency in the OFF state was good. Second, construct validity was supported by strong correlations with established MDS-NMS measures of overall non-motor burden and NMF, together with a weaker relationship with motor severity. Third, the instrument clearly differentiated participants with versus without MDS-NMS-defined NMF. Fourth, the scale showed large standardized responsiveness during an acute dopaminergic challenge. In addition, all eight a priori construct-validity hypotheses were supported, strengthening the interpretation of the correlation pattern beyond statistical significance alone.

The findings should be interpreted in relation to existing NMF instruments rather than as evidence that the NMSS-OFF/ON replaces them. The MDS-NMS provides comprehensive characterization of NMS and includes a validated NMF subscale (Martinez-Martin et al. 2019; Chaudhuri et al. 2020; Cubo et al. 2023), whereas NoMoFA was specifically developed as a patient-rated questionnaire for NMF and has demonstrated robust psychometric performance in large validation cohorts (Kleiner et al. 2021; Balestrino et al. 2025). More recently, an 11-symptom ON/OFF questionnaire was validated in 310

patients undergoing standardized dopaminergic challenge, directly supporting the feasibility of state-specific quantification of NMF (Faggianelli et al. 2024). The NMSS-OFF/ON differs principally in its brevity, clinician administration, 0–4 severity anchors, and repeated assessment over short intervals. These features may be advantageous for acute challenge paradigms, although they require confirmation in a dedicated external validation cohort. The French ON/OFF questionnaire is conceptually close in its state-specific assessment, whereas the present scale emphasizes a simple five-category clinician-rated severity response for each symptom at each measurement point (Faggianelli et al. 2024). This is a distinct implementation rather than proof of superior measurement performance.

The pattern of convergent and divergent associations is clinically coherent. The strongest correlations involved MDS-NMS NMF indices, while the relationship with UPDRS-III OFF was weak. This is consistent with evidence that NMF can be partially dissociated from motor fluctuations and should be assessed directly (Witjas et al. 2002; Storch et al. 2013; Franke and Storch 2017; Boura et al. 2025; Kakimoto et al. 2023; Regensburger et al. 2026; Storch et al. 2015; Faggianelli et al. 2024; Donzuso et al. 2024). The association with PDQ-39 also supports clinical relevance, although quality of life is a broader construct and was not expected to correlate as strongly as dedicated NMF measures. Direct contemporaneous clinician assessment may capture symptom severity at the time of an OFF or ON examination rather than relying solely on retrospective impressions of change. Recall, response-shift, and expectation effects may influence global retrospective judgments, particularly when several symptoms fluctuate differently. The five ordered severity categories (none, mild, moderate, severe, very severe) provide clear verbal anchors and a consistent scoring rule across visits. Compared with an unanchored 0–10 numerical rating, this design may be easier to administer consistently; however, superiority in reliability, responsiveness, or susceptibility to bias has not been established in a head-to-head study.

The responsiveness results are notable. Responsiveness is a distinct measurement property for instruments intended to detect change over time (Terwee et al. 2007; Guyatt et al. 1992). In this dataset, SRMs exceeded 1 at 30 and 60 min and remained 0.88 at 90 min. These values indicate a large signal relative to within-person change variability in the context of an intervention known to produce rapid clinical improvement. Randomized trials and pharmacokinetic studies have established the rapid motor effect of inhaled levodopa during OFF episodes, within the broader role of on-demand therapies for fluctuating PD (Weise and Gandor 2026; LeWitt et al. 2016, 2019; Hauser et al. 2019, 2023), and the parent INLEVO-LIFE PD study reported improvement in OFF-related NMS (Santos García et al. 2026a). The present analysis does not re-establish treatment efficacy; rather, it uses this dynamic setting to test whether the instrument detects clinically expected state change.

Item-level findings also highlight limitations. Dysphagia, bladder urgency, and akathisia showed substantial floor effects, reducing their contribution to discrimination and responsiveness in this sample. Nevertheless, deleting individual items produced little or no improvement in α . Given the heterogeneous nature of NMF, low prevalence in a small cohort is insufficient justification for item removal. Larger samples should examine whether these symptoms contribute clinically meaningful information in different phenotypes and disease stages. The metric behavior was not uniform: fatigue and bad mood

combined greater baseline severity with marked change over time; mind dullness, sweating, anxiety, and dizziness also showed multiplicity-adjusted temporal effects. Pain showed only nominal change, whereas dysphagia, urinary urgency, and akathisia were limited by low baseline endorsement and did not show significant adjusted change. These differences favor reporting item profiles alongside the total score and investigating item relevance in broader NMF phenotypes.

The exploratory AUC of 0.886 suggests that the total score may distinguish patients with established NMF from those without NMF. However, this result should be interpreted cautiously. The comparator was another non-motor instrument rather than an independent diagnostic gold standard, the sample was small, and the confidence interval was wide. Accordingly, the proposed ≥ 3 threshold is hypothesis-generating and should not be used clinically until externally validated.

This study has several limitations. The sample size was small and derived from a treatment study rather than a dedicated scale-development cohort. This precluded robust structural validity analyses and stable subgroup analyses. Content validity was not formally established through patient cognitive interviews and expert consensus within the present project, an important issue because content validity is fundamental in contemporary measurement-instrument methodology (Terwee et al. 2018). Test-retest reliability could not be assessed because serial measurements followed active treatment and were expected to change. The available CGI-I assessments reflected global status over a longer interval and were therefore not appropriate anchors for an acute MCID. The 10 symptoms are equally weighted despite potentially different clinical relevance, and several items showed marked floor effects. Finally, the instrument was evaluated in Spanish clinical practice and requires independent external and cross-cultural validation. The hypotheses were formulated for this secondary analysis rather than registered prospectively before the parent study; their complete confirmation should therefore be regarded as preliminary rather than independent confirmation.

These limitations define a clear validation roadmap. A prospective multicenter study should enroll a substantially larger and phenotypically diverse PD cohort, include patient and expert assessment of content validity, obtain a stable retest condition for ICC and measurement error, examine dimensionality using appropriate methods for ordinal data, test predefined construct-validity hypotheses, and incorporate a temporally matched patient global rating of change to estimate meaningful change. Comparison with NoMoFA and the MDS-NMS NMF subscale would permit direct assessment of incremental utility and administration burden.

Conclusions

The NMSS-OFF/ON demonstrated good internal consistency, expected associations with established non-motor measures, known-groups discrimination, and strong responsiveness during acute OFF-to-ON transitions in this preliminary analysis. Its principal potential value is as a brief state-specific instrument for repeated quantification of non-motor symptom severity over short intervals. These results support

further prospective validation but are insufficient to establish definitive structural validity, reproducibility, an MCID, or a clinical diagnostic cut-off.

Declarations

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Ethics approval: The INLEVO-LIFE PD study was conducted in accordance with the Declaration of Helsinki and applicable Spanish regulations. The study was approved by the Comité de Ética de Investigación de medicamentos de Galicia (CEImG), Spain, on November 29, 2023.

Consent to participate: Written informed consent was obtained from all participants before inclusion in the INLEVO-LIFE PD study.

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Data availability: The protocol and statistical analysis plan are available on request. Deidentified participant data are not available for legal and ethical reasons.

Author contributions: Diego Santos García: conceptualization, investigation, funding acquisition, writing – original draft, methodology, validation, visualization, writing – review and editing, formal analysis, data curation, supervision, resources. María Cerdán Sánchez: investigation, writing – review and editing. Rosa Yáñez Baña: investigation, writing – review and editing. Iria Cabo: investigation, writing – review and editing. Maria Iciar Cimas Hernando: investigation, writing – review and editing. All authors approved the final manuscript.

Competing interests: Diego Santos-García has received honoraria for educational presentations and advisory services from AbbVie, UCB Pharma, Lundbeck, KRKA, Zambon, Bial, Italfarmaco, Teva, Archímedes, Esteve, Stada, and Orion Pharma; financial compensation for INIBIC/Fundación Professor Novoa Santos related to activity as principal investigator in phase 2–4 clinical trials in Parkinson's disease and other movement disorders; compensation for Fundación Degen related to different projects; and grants from Fundación Professor Novoa Santos through the 2023/2024 call for research projects for emerging and associated INIBIC groups. María Cerdán Sánchez has received honoraria for educational presentations from AbbVie, KRKA, Zambon, Bial, Italfarmaco, Esteve, and Stada. Rosa Yáñez Baña has received honoraria for educational presentations and advisory services from AbbVie, Esteve, Italfarmaco, Bial, Stada, and Orion Pharma. Iria Cabo has received honoraria for educational presentations and advisory services from AbbVie, UCB Pharma, Zambon, Bial, Italfarmaco, Teva, Esteve, Stada, and Orion Pharma. Maria Iciar Cimas Hernando has nothing to report.

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Tables

Table 1. OFF-state item characteristics and internal consistency.

Item	Mean $\pm$ SD	Floor %	Ceiling %	Corrected item-total ρ	α if deleted
Pain	0.63 $\pm$ 1.11	71.4	2.9	0.444	0.805
Bad mood	1.06 $\pm$ 1.37	54.3	2.9	0.700	0.784
Anxiety	0.86 $\pm$ 1.17	57.1	2.9	0.530	0.801
Fatigue	1.29 $\pm$ 1.32	34.3	0	0.653	0.804
Dizziness	0.54 $\pm$ 0.98	71.4	0	0.280	0.809
Mind dullness	0.89 $\pm$ 1.02	48.6	0	0.621	0.789
Akathisia	0.43 $\pm$ 0.88	77.1	0	0.303	0.824
Dysphagia	0.14 $\pm$ 0.49	91.4	0	0.249	0.831
Bladder urgency	0.37 $\pm$ 0.88	82.9	0	0.336	0.832
Sweating	0.63 $\pm$ 0.97	68.6	0	0.525	0.799

Overall Cronbach α =0.825 (bootstrap 95% CI 0.678–0.890); standardized α =0.810. N=35.

Table 2. Construct validity of the OFF-state NMSS-OFF/ON total score.

Comparator	N	Spearman ρ	p
MDS-NMS total	34	0.689	0.000007
MDS-NMS NMF Change	31	0.768	<0.000001
MDS-NMS NMF Time	31	0.754	0.000001
MDS-NMS NMF Change $\times$ Time	32	0.719	0.000004
PDQ-39 Summary Index	34	0.599	0.000184
UPDRS-III OFF	35	0.239	0.167
UPDRS-IV total	34	0.294	0.091
CGI-I patient	34	0.089	0.616
CGI-I neurologist	34	0.175	0.323

Table 3. Responsiveness and item-level temporal effects.

Outcome	OFF	30 min	60 min	90 min	Friedman χ^2	Raw p	Holm p
Total score	6.65	2.09	1.91	2.71	56.13	3.93×10^{-12}	—
Pain	0.65	0.21	0.24	0.35	8.91	0.0305	0.122
Bad mood	1.03	0.24	0.21	0.32	33.73	2.26×10^{-7}	2.03×10^{-6}
Anxiety	0.85	0.29	0.21	0.53	17.77	0.000492	0.00295
Fatigue	1.26	0.35	0.29	0.50	44.29	1.31×10^{-9}	1.31×10^{-8}
Dizziness	0.56	0.15	0.15	0.29	17.28	0.000618	0.00309
Mind dullness	0.82	0.18	0.32	0.29	27.98	3.67×10^{-6}	2.94×10^{-5}
Akathisia	0.44	0.18	0.15	0.29	4.50	0.212	0.456
Dysphagia	0.15	0.03	0.03	0.06	5.29	0.152	0.456
Bladder urgency	0.29	0.18	0.18	0.18	5.22	0.156	0.456
Sweating	0.59	0.12	0.09	0.18	20.43	0.000138	0.000969

N=34 complete repeated-measures cases. Holm correction applies to the 10 individual-item tests.

Figures

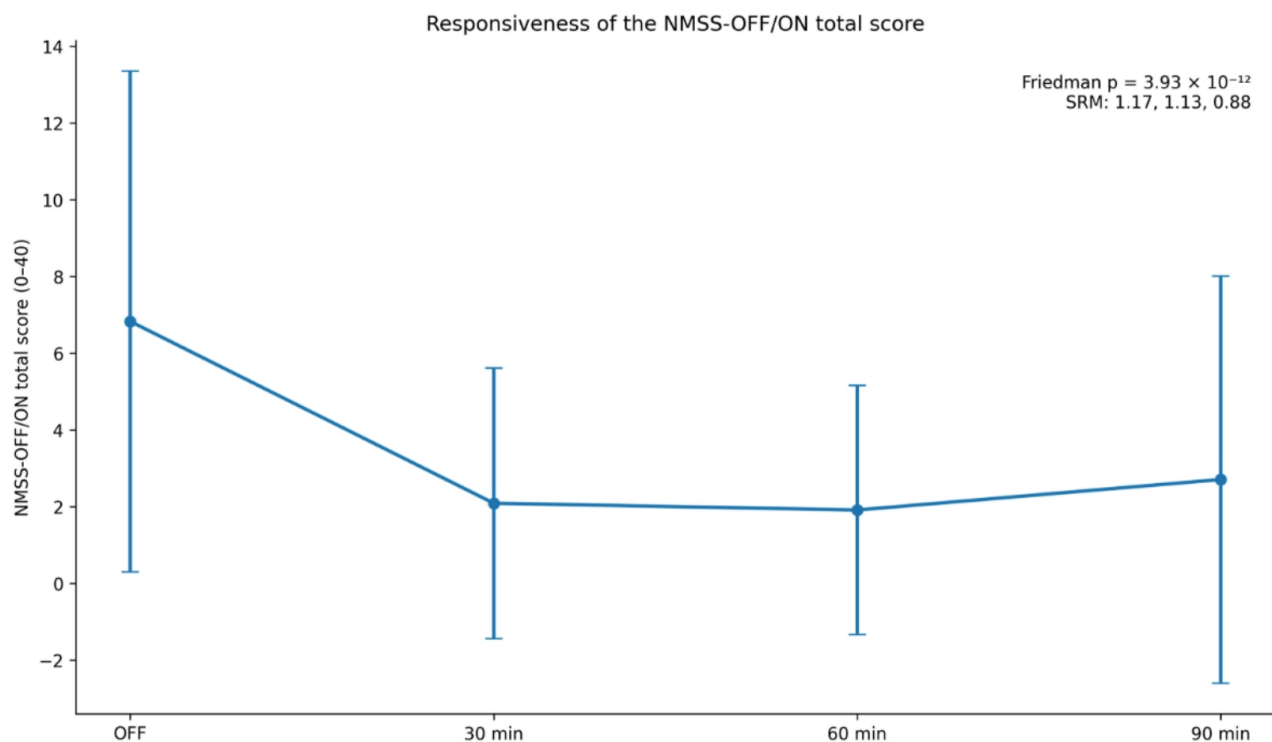


Figure 1

Responsiveness of the NMSS-OFF/ON total score after inhaled levodopa. Error bars represent SD.

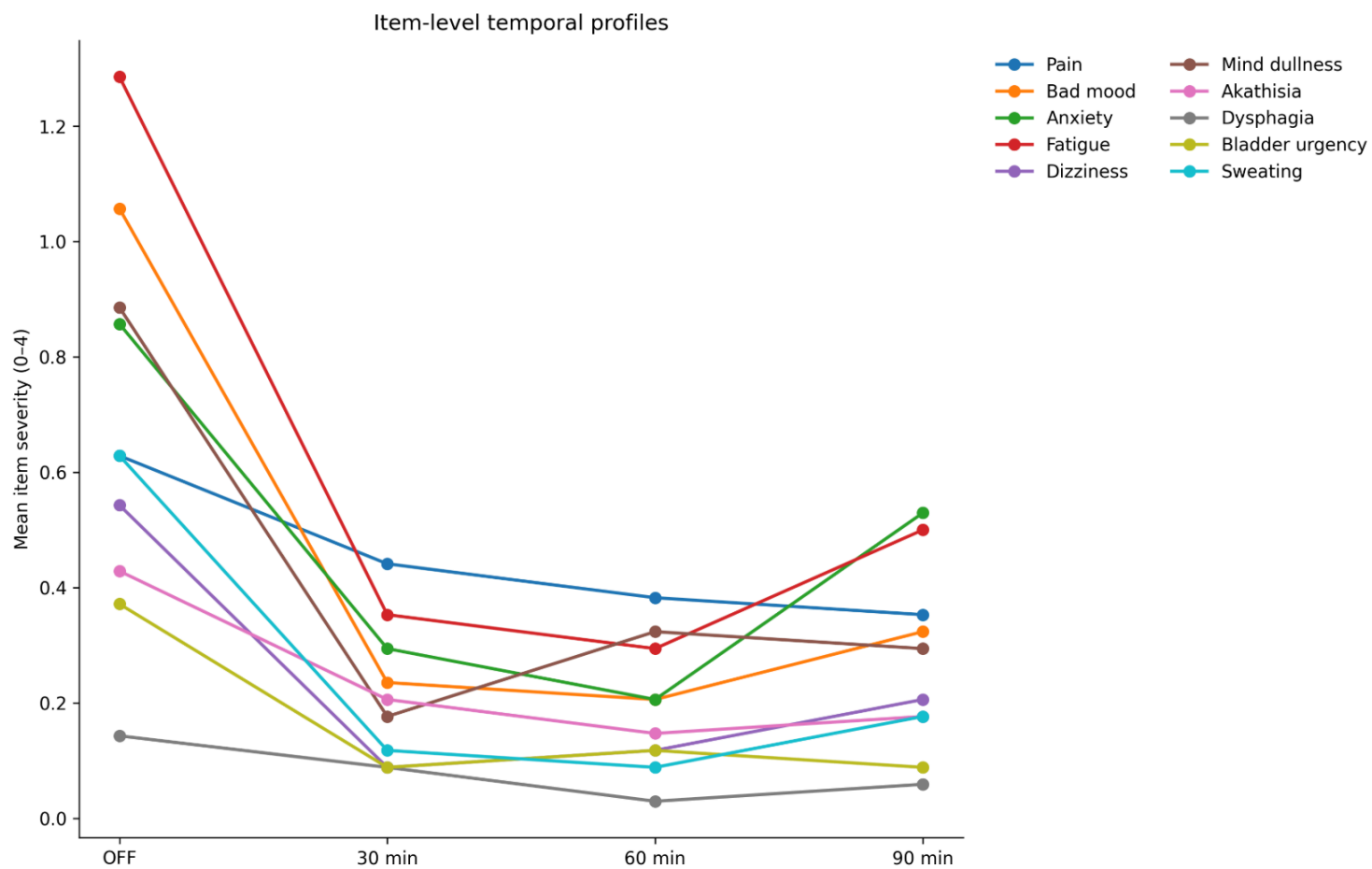


Figure 2

Mean item-level temporal profiles from OFF through 90 min after inhaled levodopa.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [NMSS.OFF.ON.SM.JNT.docx](#)