

Table S1. Percentage of individuals with 1SD below the normative mean among participants with PD in PPMI

|                                | Published Norms | Internal HC Overall Group-Based Norms | Relative Risk of Impaired Performance | Published Norms | Internal HC Age-Based Norms | Relative Risk of Impaired Performance |
|--------------------------------|-----------------|---------------------------------------|---------------------------------------|-----------------|-----------------------------|---------------------------------------|
| <b>HVLT-R Immediate Recall</b> |                 |                                       |                                       |                 |                             |                                       |
| Baseline Form 1                | 31.0%           | 28.0%                                 | 0.9                                   | 31.0%           | 29.1%                       | 0.9                                   |
| 12-month Form 2                | 27.0%           | 32.4%                                 | 1.2                                   | 27.0%           | 32.7%                       | 1.2                                   |
| 24-month Form 3                | 30.4%           | 31.0%                                 | 1.0                                   | 30.4%           | 35.3%                       | 1.2                                   |
| 36-month Form 4                | 24.4%           | 28.7%                                 | 1.2                                   | 24.4%           | 30.1%                       | 1.2                                   |
| <b>HVLT-R Delayed Recall</b>   |                 |                                       |                                       |                 |                             |                                       |
| Baseline Form 1                | 32.9%           | 15.6%                                 | 0.5                                   | 32.9%           | 27.0%                       | 0.8                                   |
| 12-month Form 2                | 37.6%           | 26.4%                                 | 0.7                                   | 37.6%           | 31.6%                       | 0.8                                   |
| 24-month Form 3                | 31.0%           | 27.9%                                 | 0.9                                   | 31.0%           | 30.1%                       | 1.0                                   |
| 36-month Form 4                | 25.0%           | 46.7%                                 | 1.9                                   | 25.0%           | 29.3%                       | 1.2                                   |
| <b>LNS</b>                     |                 |                                       |                                       |                 |                             |                                       |
| Baseline                       | 6.4%            | 21.1%                                 | 3.3                                   | 6.4%            | 13.7%                       | 2.1                                   |
| 12-month                       | 8.7%            | 22.3%                                 | 2.6                                   | 8.7%            | 17.7%                       | 2.0                                   |
| 24-month                       | 7.1%            | 22.7%                                 | 3.2                                   | 7.1%            | 17.0%                       | 2.4                                   |
| 36-month                       | 10.8%           | 25.8%                                 | 2.4                                   | 10.8%           | 21.5%                       | 2.0                                   |
| <b>JLO</b>                     |                 |                                       |                                       |                 |                             |                                       |
| Baseline Odd Numbered Items    | 5.2%            | 8.8%                                  | 1.7                                   | 5.2%            | 13.3%                       | 2.6                                   |
| 12-month Even Numbered Items   | 7.9%            | 19.9%                                 | 2.5                                   | 7.9%            | 22.3%                       | 2.8                                   |
| 24-month Odd Numbered Items    | 5.8%            | 13.7%                                 | 2.4                                   | 5.8%            | 14.8%                       | 2.6                                   |
| 36-month Even Numbered Items   | 6.4%            | 16.9%                                 | 2.6                                   | 6.4%            | 22.7%                       | 3.5                                   |
| <b>Semantic Fluency</b>        |                 |                                       |                                       |                 |                             |                                       |
| Baseline                       | 14.5%           | 22.0%                                 | 1.5                                   | 14.5%           | 23.5%                       | 1.6                                   |
| 12-month                       | 14.2%           | 28.9%                                 | 2.0                                   | 14.2%           | 21.5%                       | 1.5                                   |
| 24-month                       | 14.0%           | 22.5%                                 | 1.6                                   | 14.0%           | 21.6%                       | 2.1                                   |
| 36-month                       | 12.5%           | 26.5%                                 | 2.1                                   | 12.5%           | 26.5%                       | 1.1                                   |
| <b>SDMT</b>                    |                 |                                       |                                       |                 |                             |                                       |
| Baseline Version 1             | 26.4%           | 29.4%                                 | 1.1                                   | 26.4%           | 29.4%                       | 1.1                                   |
| 12-months Version 2            | 27.3%           | 30.8%                                 | 1.1                                   | 27.3%           | 31.1%                       | 1.1                                   |
| 24-months Version 1            | 30.4%           | 47.1%                                 | 1.5                                   | 30.4%           | 28.8%                       | 0.9                                   |
| 36-months Version 2            | 32.0%           | 35.9%                                 | 1.1                                   | 32.0%           | 37.3%                       | 1.2                                   |

Notes: PPMI = Parkinson's Progressive Marker Initiative; HC = Healthy Control; HVLT-R = Hopkins Verbal Learning Test Revised; LNS = Letter Number Sequencing; JLO = Judgment of Line Orientation; SDMT = Symbol Digit Modalities Test; Internally Normed z-scores were derived from the mean of the participant score minus the group mean of the healthy control group, divided by the standard deviation of the group mean of the healthy control group for each measure. The HC Overall Group Norms are based on the mean and standard deviation of the entire HC sample. The HC Age-Based Norms utilized norms from the following age ranges: 30-45, 46-60, 61-75, 76-90. Impaired is defined as less than 1 standard deviations below the normative mean.

Table S2. Percentage of individuals with 1.5 SD below the normative mean among participants with PD in PPMI

|                                | Published Norms | Internal HC Overall Group-Based Norms | Relative Risk of Impaired Performance | Published Norms | Internal HC Age-Based Norms | Relative Risk of Impaired Performance |
|--------------------------------|-----------------|---------------------------------------|---------------------------------------|-----------------|-----------------------------|---------------------------------------|
| <b>HVLT-R Immediate Recall</b> |                 |                                       |                                       |                 |                             |                                       |
| Baseline Form 1                | 17.3%           | 16.3%                                 | 0.9                                   | 17.3%           | 14.7%                       | 0.8                                   |
| 12-month Form 2                | 16.3%           | 21.8%                                 | 1.3                                   | 16.3%           | 16.6%                       | 1.0                                   |
| 24-month Form 3                | 18.9%           | 19.2%                                 | 1.0                                   | 18.9%           | 21.4%                       | 1.1                                   |
| 36-month Form 4                | 13.0%           | 17.7%                                 | 1.4                                   | 13.0%           | 18.8%                       | 1.4                                   |
| <b>HVLT-R Delayed Recall</b>   |                 |                                       |                                       |                 |                             |                                       |
| Baseline Form 1                | 16.4%           | 14.2%                                 | 0.9                                   | 16.4%           | 14.2%                       | 0.9                                   |
| 12-month Form 2                | 18.3%           | 18.0%                                 | 1.0                                   | 18.3%           | 18.8%                       | 1.0                                   |
| 24-month Form 3                | 14.8%           | 18.9%                                 | 1.3                                   | 14.8%           | 18.9%                       | 1.3                                   |
| 36-month Form 4                | 15.7%           | 13.3%                                 | 0.8                                   | 15.7%           | 17.7%                       | 1.1                                   |
| <b>LNS</b>                     |                 |                                       |                                       |                 |                             |                                       |
| Baseline                       | 2.4%            | 10.4%                                 | 4.3                                   | 2.4%            | 7.1%                        | 3.0                                   |
| 12-month                       | 2.5%            | 6.8%                                  | 2.7                                   | 2.5%            | 8.7%                        | 3.5                                   |
| 24-month                       | 3.8%            | 12.6%                                 | 3.3                                   | 3.8%            | 9.0%                        | 2.4                                   |
| 36-month                       | 6.6%            | 10.5%                                 | 1.6                                   | 6.6%            | 8.2%                        | 1.2                                   |
| <b>JLO</b>                     |                 |                                       |                                       |                 |                             |                                       |
| Baseline Odd Numbered Items    | 0.2%            | 15.9%                                 | 79.5                                  | 0.2%            | 11.8%                       | 59.0                                  |
| 12-month Even Numbered Items   | 1.1%            | 12.5%                                 | 11.4                                  | 1.1%            | 14.4%                       | 13.1                                  |
| 24-month Odd Numbered Items    | 1.4%            | 14.0%                                 | 10.0                                  | 1.4%            | 12.1%                       | 8.6                                   |
| 36-month Even Numbered Items   | 0.8%            | 11.3%                                 | 14.2                                  | 0.8%            | 18.2%                       | 22.8                                  |
| <b>Semantic Fluency</b>        |                 |                                       |                                       |                 |                             |                                       |
| Baseline                       | 1.9%            | 10.7%                                 | 5.6                                   | 1.9%            | 8.5%                        | 4.5                                   |
| 12-month                       | 3.0%            | 7.9%                                  | 2.6                                   | 3.0%            | 8.2%                        | 2.7                                   |
| 24-month                       | 3.0%            | 13.2%                                 | 4.4                                   | 3.0%            | 11.0%                       | 3.7                                   |
| 36-month                       | 2.8%            | 11.6%                                 | 4.1                                   | 2.8%            | 11.6%                       | 4.1                                   |
| <b>SDMT</b>                    |                 |                                       |                                       |                 |                             |                                       |
| Baseline Version 1             | 6.6%            | 14.2%                                 | 2.2                                   | 6.6%            | 13.3%                       | 2.0                                   |
| 12-months Version 2            | 7.1%            | 16.9%                                 | 2.4                                   | 7.1%            | 16.1%                       | 2.3                                   |
| 24-months Version 1            | 8.8%            | 27.1%                                 | 3.1                                   | 8.8%            | 17.0%                       | 1.9                                   |
| 36-months Version 2            | 11.6%           | 23.5%                                 | 2.0                                   | 11.6%           | 23.8%                       | 2.1                                   |

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Table S3. Percentage of individuals with 2SD below the normative mean among participants with PD in PPMI

|                                | Published Norms | Internal HC Overall Group-Based Norms | Relative Risk of Impaired Performance | Published Norms | Internal HC Age-Based Norms | Relative Risk of Impaired Performance |
|--------------------------------|-----------------|---------------------------------------|---------------------------------------|-----------------|-----------------------------|---------------------------------------|
| <b>HVLT-R Immediate Recall</b> |                 |                                       |                                       |                 |                             |                                       |
| Baseline Form 1                | 6.9%            | 9.7%                                  | 1.4                                   | 6.9%            | 7.8%                        | 1.1                                   |
| 12-month Form 2                | 7.1%            | 12.5%                                 | 1.8                                   | 7.1%            | 10.6%                       | 1.5                                   |
| 24-month Form 3                | 11.5%           | 6.6%                                  | 0.6                                   | 11.5%           | 10.1%                       | 0.9                                   |
| 36-month Form 4                | 5.5%            | 11.3%                                 | 2.1                                   | 5.5%            | 12.7%                       | 2.3                                   |
| <b>HVLT-R Delayed Recall</b>   |                 |                                       |                                       |                 |                             |                                       |
| Baseline Form 1                | 6.2%            | 7.3%                                  | 1.2                                   | 6.2%            | 7.3%                        | 1.2                                   |
| 12-month Form 2                | 9.5%            | 11.44%                                | 1.2                                   | 9.5%            | 11.7%                       | 1.2                                   |
| 24-month Form 3                | 8.5%            | 11.2%                                 | 1.3                                   | 8.5%            | 11.2%                       | 1.3                                   |
| 36-month Form 4                | 8.0%            | 3.0%                                  | 0.4                                   | 8.0%            | 13.0%                       | 1.6                                   |
| <b>LNS</b>                     |                 |                                       |                                       |                 |                             |                                       |
| Baseline                       | 2.4%            | 3.1%                                  | 1.3                                   | 2.4%            | 4.0%                        | 1.7                                   |
| 12-month                       | 1.1%            | 3.5%                                  | 3.2                                   | 1.1%            | 4.4%                        | 4.0                                   |
| 24-month                       | 1.9%            | 5.8%                                  | 3.1                                   | 1.9%            | 6.6%                        | 3.5                                   |
| 36-month                       | 3.0%            | 6.6%                                  | 2.2                                   | 3.0%            | 8.0%                        | 2.7                                   |
| <b>JLO</b>                     |                 |                                       |                                       |                 |                             |                                       |
| Baseline Odd Numbered Items    | 0.0%            | 8.8%                                  | -                                     | 0.0%            | 9.2%                        | -                                     |
| 12-month Even Numbered Items   | 0.3%            | 4.4%                                  | 14.7                                  | 0.3%            | 10.9%                       | 36.3                                  |
| 24-month Odd Numbered Items    | 0.3%            | 5.8%                                  | 19.3                                  | 0.3%            | 7.7%                        | 25.7                                  |
| 36-month Even Numbered Items   | 0.3%            | 7.5%                                  | 25.0                                  | 0.3%            | 9.7%                        | 32.3                                  |
| <b>Semantic Fluency</b>        |                 |                                       |                                       |                 |                             |                                       |
| Baseline                       | 1.9%            | 1.7%                                  | 0.9                                   | 1.9%            | 1.7%                        | 0.9                                   |
| 12-month                       | 3.0%            | 4.4%                                  | 1.5                                   | 3.0%            | 3.0%                        | 1.0                                   |
| 24-month                       | 3.0%            | 3.6%                                  | 1.2                                   | 3.0%            | 3.0%                        | 1.0                                   |
| 36-month                       | 2.8%            | 4.7%                                  | 1.7                                   | 2.8%            | 3.6%                        | 1.3                                   |
| <b>SDMT</b>                    |                 |                                       |                                       |                 |                             |                                       |
| Baseline Version 1             | 6.6%            | 6.2%                                  | 0.9                                   | 6.6%            | 7.1%                        | 1.1                                   |
| 12-months Version 2            | 7.1%            | 6.8%                                  | 1.0                                   | 7.1%            | 9.0%                        | 1.3                                   |
| 24-months Version 1            | 8.8%            | 14.5%                                 | 1.6                                   | 8.8%            | 9.3%                        | 1.1                                   |
| 36-months Version 2            | 11.6%           | 14.1%                                 | 1.2                                   | 11.6%           | 14.6%                       | 1.3                                   |

Notes: PPMI = Parkinson's Progressive Marker Initiative; HC =Healthy Control; HVLT-R = Hopkins Verbal Learning Test Revised; LNS = Letter Number Sequencing; JLO = Judgment of Line Orientation; SDMT = Symbol Digit Modalities Test; Internally Normed z-scores were derived from the mean of the participant score minus the group mean of the healthy control group, divided by the standard deviation of the group mean of the healthy control group for each measure. The HC Overall Group Norms are based on the mean and standard deviation of the entire HC sample. The HC Age-Based Norms utilized norms from the following age ranges: 30-45, 46-60, 61-75, and 76-90. Impaired is defined as less than 2 standard deviations below the normative mean.