Phenoconversion in PPMI

OUTLINE

- Definitions of phenoconversion
- Characteristics of phenoconverters

DEFINING PHENOCONVERSION IN PPPMI

DEFINITION OF PHENOCONVERSION

- Data-driven
- Diagnostic codes
- …biomarkers…

DATA-DRIVEN

1. Excessive stroke risk factors (e.g., diabetes, hypertension, cardiovascular disease) or past symptoms suggestive of cerebrovascular disease — 1. ☐
2. Unusual or atypical risk factors, exposure, or past history (e.g., drug exposure, acute or chronic toxin exposure, acute infection preceding parkinsonism, repeated head trauma, boxer) — 2. ☐
3. Unusual or atypical presenting features or symptoms — 3. ☐
4. Unusual or atypical course of disease:
   - 4.1 Very rapid progression — 4.1 ☐
   - 4.2 Static or little change — 4.2 ☐
   - 4.3 Hemiparkinsonism longer than 6 years — 4.3 ☐
   - 4.4 Onset before age 30 — 4.4 ☐
   - 4.5 Other, specify: _____ — 4.5 ☐

Specific Clinical Features: Answer 0 = No or 1 = Yes for each item.

5. Tremor:
   - 5.1 Resting tremor present and typical for PD — 5.1 ☐
   - 5.2 Resting tremor absent — 5.2 ☐
   - 5.3 Prominent action tremor — 5.3 ☐
   - 5.4 Other, specify: _____ — 5.4 ☐
6. Rigidity:
   - 6.1 Rigidity is present and typical for PD — 6.1 ☐
   - 6.2 Rigidity is absent — 6.2 ☐
   - 6.3 Axial rigidity in excess of distal rigidity — 6.3 ☐
   - 6.4 Marked unilateral or asymmetric rigidity — 6.4 ☐
   - 6.5 Additional type of increased tone (i.e., paratonia, mitgehen, spasticity) — 6.5 ☐
   - 6.6 Other, specify: _____ — 6.6 ☐

 (12/12/07) 4/23/12

PPMI

1 3 2 DIAGNOSTIC FEATURES (PD) 1 7

SUBJECT ID ☐☐☐☐ VISIT NO ☐☐☐

Specific Clinical Features: Answer 0 = No or 1 = Yes for each item.

7. Akinesia/Bradykinesia:
   - 7.1 Bradykinesia is present and typical for PD — 7.1 ☐
   - 7.2 Bradykinesia is absent — 7.2 ☐
   - 7.3 Pure Akinesia (without rigidity or tremor) — 7.3 ☐
   - 7.4 Bradykinesia does not completely account for difficulty with rapid successive movements (e.g., apraxia, ataxia, pyramidal tract dysfunction) — 7.4 ☐
   - 7.5 Other, specify: _____ — 7.5 ☐
8. Postural or gait disturbances:
   - 8.1 Postural and gait disturbances are completely typical of PD — 8.1 ☐
   - 8.2 Wide-based gait or ataxia — 8.2 ☐
   - 8.3 Prominent freezing early in course — 8.3 ☐
   - 8.4 Likely to fall if not extra careful — 8.4 ☐
   - 8.5 Other, specify: _____ — 8.5 ☐
9. Mental Changes:
   - 9.1 Psychiatric — 9.1 ☐
   - 9.2 Cognitive — 9.2 ☐
10. Other hyperkinesias (not related to levodopa or agonists):
    - 10.1 Dystonia — 10.1 ☐
    - 10.2 Chorea — 10.2 ☐
    - 10.3 Myoclonus (include stimulus-induced) — 10.3 ☐
    - 10.4 Other (e.g., alien limbs): _____ — 10.4 ☐
11. Presence of body hemiatrophy — 11. ☐
12. Autonomic disturbances:
    - 12.1 Postural hypotension — 12.1 ☐
    - 12.2 Sexual dysfunction — 12.2 ☐
    - 12.3 Urinary dysfunction — 12.3 ☐
    - 12.4 Bowel dysfunction — 12.4 ☐

 (12/12/07) 4/23/12

DATA-DRIVEN

- Diagnostic Features Questionnaire responses:
  - Bradykinesia present and typical for PD (Question 7.1=1)

and at least one of the following:

- Resting tremor present and typical for PD (Question 5.1=1)
- Rigidity present and typical for PD (Question 6.1=1)
- Postural/gait disturbances present and typical for PD (Question 8.1=1)

DIAGNOSTIC CODES

PPMI

1 3 2 **PRODROMAL DIAGNOSTIC QUESTIONNAIRE** 1 5

SUBJECT ID _____ VISIT NO _____

INITIALS _____ SITE NO _____ VISIT DATE _____ _____ _____
MM DD YYYY

1. Indicate the current most likely clinical diagnosis from one of the categories listed below (choose one): 1. _____

01 = Idiopathic PD
02 = Alzheimer's disease
03 = Chromosome-17 frontotemporal dementia
04 = Corticobasal degeneration
05 = Dementia with Lewy bodies
06 = Dopa-responsive dystonia
07 = Essential tremor
08 = Hemiparkinson/hemiatrophy syndrome
09 = Juvenile autosomal recessive parkinsonism
10 = Motor neuron disease with parkinsonism
11 = Multiple system atrophy
12 = Neuroleptic-induced parkinsonism
13 = Normal pressure hydrocephalus
14 = Progressive supranuclear palsy
15 = Psychogenic illness
16 = Vascular parkinsonism
17 = No PD nor other neurological disorder
18 = Spinocerebellar Ataxia (SCA)
23 = Prodromal non-motor PD (at least one non-motor symptom and no motor symptoms)
24 = Prodromal motor PD (at least one motor symptom to meet eligibility for enrollment in PPMI as PD subject)
97 = Other neurological disorder(s) (specify)_____

DIAGNOSTIC CODES

PPMI

1 3 2 **PRODROMAL DIAGNOSTIC QUESTIONNAIRE** 1 5

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MM DD YYYY

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97 = Other neurological disorder(s) (specify)_____

Asymptomatic genetic=17

DIAGNOSTIC CODES

PPMI

1 3 2 **PRODROMAL DIAGNOSTIC QUESTIONNAIRE** 1 5

SUBJECT ID _____ VISIT NO _____

INITIALS _____ SITE NO _____ VISIT DATE _____ _____ _____
MM DD YYYY

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DIAGNOSTIC CODES

PPMI

1 3 2 **PRODROMAL DIAGNOSTIC QUESTIONNAIRE** 1 5

SUBJECT ID ☐☐☐☐☐ VISIT NO ☐☐☐

INITIALS ☐☐☐ SITE NO ☐☐☐ VISIT DATE ☐☐ ☐☐ ☐☐☐☐
MM DD YYYY

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DIAGNOSTIC CODES

PPMI

1 3 2 **PRODROMAL DIAGNOSTIC QUESTIONNAIRE** 1 5

SUBJECT ID ☐☐☐☐☐ VISIT NO ☐☐☐

INITIALS ☐☐☐ SITE NO ☐☐☐ VISIT DATE ☐☐ ☐☐ ☐☐☐☐
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1. Indicate the current most likely clinical diagnosis from one of the categories listed below (choose one): 1. ☐☐

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97 = Other neurological disorder(s) (specify)_____

Considerations regarding code 97 (see next slide)

DIAGNOSTIC CODES

Notes to site PIs:

- "Other" (code 97) should not be used to indicate non-specific exam findings (like "tremor NOS")
- Code LRRK2-associated PD as idiopathic PD
- Comorbid conditions should be listed in medical conditions log even if they are neurologic:
  - Multiple Sclerosis
  - Tremor NOS
  - Peripheral Neuropathy

DIAGNOSTIC CODES

Notes to site PIs:

- Be mindful of code “fluctuations”, especially once a neurodegenerative parkinsonism code is assigned

BIOMARKER-DEFINED CONVERSION

- Future work will aim to define biomarker-based algorithms to identify phenoconversion including but not limited to:
  - Imaging
  - CSF
  - Questionnaire responses
  - Smell test
  - Exam findings
  - Wearable data

CHARACTERISTICS OF PHENOCONVERTERS IN PPMI

CONVERTERS VS. NONCONVERTERS

When conversion is defined as code=24:
"Prodromal Motor PD"
or change to a neurodegenerative parkinsonism

- 60 cases have "converted"
  - 32 (53.3%) Genetic cohort
  - 12 (20.0%) Hyposmia cohort
  - 16 (26.7%) RBD cohort

- NOTE: mean follow-up time 34.2 months in converters vs. 19.8 months in non-converters ($p<0.0001$)

CONVERTERS VS. NONCONVERTERS

Variable	Non-Converters (N = 240)	Converters (N = 60)	p-value
Age			
Mean (SD)	62.57 (7.40)	65.61 (8.79)	**0.0156**
(Min, Max)	(33.72, 84.30)	(50.39, 82.53)	
Gender			
Male	109 (45.42%)	34 (56.67%)	0.1186
Female	131 (54.58%)	26 (43.33%)	
Smell Category			
Normosmia	99 (41.42%)	8 (13.56%)	**0.0001**
Hyposmia/Anosmia	140 (58.58%)	51 (86.44%)	
Missing	1	1	
MDS-UPDRS I			
Mean (SD)	4.86 (4.05)	6.15 (4.53)	**0.0407**
Median	4.00	5.50	
(Min, Max)	(0.00, 24.00)	(0.00, 17.00)	
MDS-UPDRS II			
Mean (SD)	0.96 (1.92)	2.33 (2.91)	**0.0002**
Median	0.00	1.00	
(Min, Max)	(0.00, 12.00)	(0.00, 10.00)	
MDS-UPDRS III			
Mean (SD)	2.23 (3.18)	4.85 (4.25)	**<.0001**
Median	1.00	4.00	
(Min, Max)	(0.00, 21.00)	(0.00, 17.00)	
Motor Asymmetry Index			
Mean (SD)	-0.03 (0.52)	-0.09 (0.61)	0.5200
Median	0.00	0.00	
(Min, Max)	(-1.00, 1.00)	(-1.00, 1.00)	
SCOPA-AUT			
Mean (SD)	8.30 (5.93)	12.83 (7.75)	**0.0001**
(Min, Max)	(0.00, 31.00)	(1.00, 38.00)	
Missing	2	1	
RBDSQ			
Mean (SD)	3.63 (2.90)	4.83 (3.79)	**0.0263**
(Min, Max)	(0.00, 12.00)	(0.00, 13.00)	
Missing	2	1	
GDS			
Mean (SD)	1.75 (2.44)	2.20 (2.30)	0.1871
(Min, Max)	(0.00, 12.00)	(0.00, 8.00)	
Missing	1	1	
MOCA			
Mean (SD)	26.73 (2.46)	26.08 (3.31)	0.1580
(Min, Max)	(14.00, 30.00)	(11.00, 30.00)	

CONVERTERS VS. NONCONVERTERS

Variable	Non-Converters (N = 240)	Converters (N = 60)	p-value
Age			
Mean (SD)	62.57 (7.40)	65.61 (8.79)	**0.0156**
(Min, Max)	(33.72, 84.30)	(50.39, 82.53)	
Gender			
Male	109 (45.42%)	34 (56.67%)	0.1186
Female	131 (54.58%)	26 (43.33%)	
Smell Category			
Normosmia	99 (41.42%)	8 (13.56%)	**0.0001**
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Motor Asymmetry Index			
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Median	0.00	0.00	
(Min, Max)	(-1.00, 1.00)	(-1.00, 1.00)	
SCOPA-AUT			
Mean (SD)	8.30 (5.93)	12.83 (7.75)	**0.0001**
(Min, Max)	(0.00, 31.00)	(1.00, 38.00)	
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(Min, Max)	(0.00, 12.00)	(0.00, 8.00)	
Missing	1	1	
MOCA			
Mean (SD)	26.73 (2.46)	26.08 (3.31)	0.1580
(Min, Max)	(14.00, 30.00)	(11.00, 30.00)	

CONVERTERS VS. NONCONVERTERS

Variable	Non-Converters (N = 240)	Converters (N = 60)	p-value
Dat Deficit			
Negative	163 (74.09%)	25 (41.67%)	**<.0001**
Positive	57 (25.91%)	35 (58.33%)	
Missing	20	0	
Putamen SBR			
Mean (SD)	2.14 (0.61)	1.54 (0.57)	**<.0001**
(Min, Max)	(0.86, 4.21)	(0.54, 2.72)	
Missing	20	0	
Striatum SBR			
Mean (SD)	2.55 (0.62)	1.99 (0.60)	**<.0001**
(Min, Max)	(1.17, 4.41)	(0.80, 3.20)	
Missing	20	0	
Putamen Asymmetry Index			
Mean (SD)	-0.00 (0.07)	0.02 (0.12)	0.1299
(Min, Max)	(-0.30, 0.28)	(-0.24, 0.32)	
Missing	20	0	
Striatum Asymmetry Index			
Mean (SD)	-0.00 (0.04)	0.01 (0.07)	0.2778
(Min, Max)	(-0.11, 0.18)	(-0.15, 0.18)	
Missing	20	0	
CSF a-synuclein			
Mean (SD)	1616.21 (659.81)	1657.20 (673.03)	0.9303
Median	1581.30	1561.20	
(Min, Max)	(398.80, 4325.50)	(474.60, 3566.30)	
Missing	156	12	
1 Year Change in a-Synuclein			
Mean (SD)	66.01 (285.75)	0.84 (194.59)	0.3769
Median	43.00	-3.70	
(Min, Max)	(-573.50, 800.30)	(-450.00, 489.10)	
Missing	203	33	

CONVERTERS VS. NONCONVERTERS

When conversion is defined as change to a neurodegenerative parkinsonism code only:

PD, PSP, MSA, DLB, CBS, FTD

- 23 cases (of the 60) have “converted” to diagnosed neurodegenerative parkinsonism
  - 5 (21.7%) Genetic cohort
  - 7(30.4%) Hyposmia cohort
  - 11(47.8%) RBD cohort

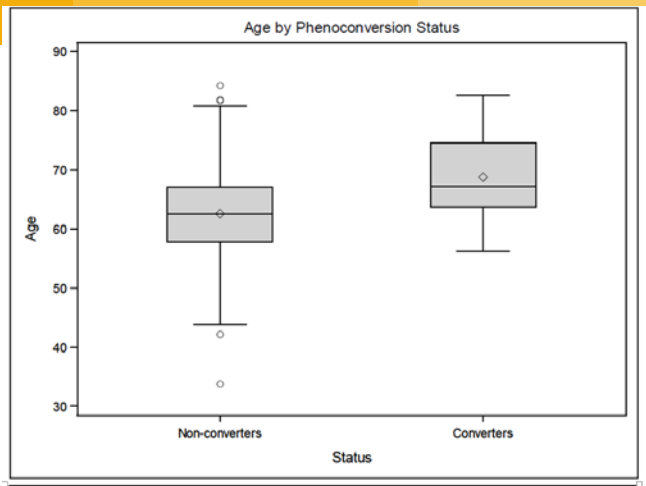
  - 19 PD, 3 DLB, 1 PSP
    (1 PD later changed to MSA)

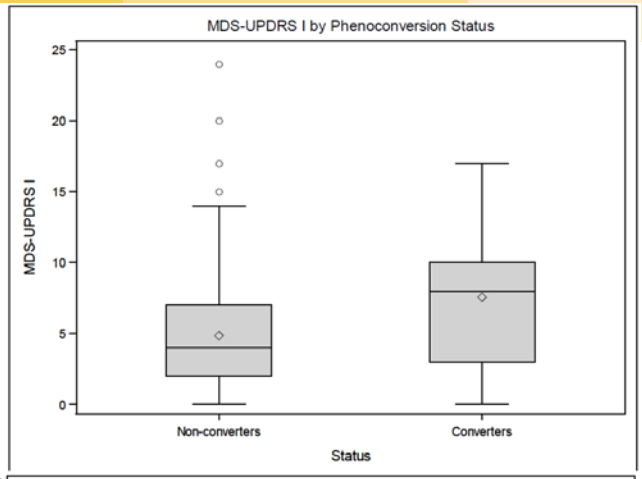
CONVERTERS VS. NONCONVERTERS

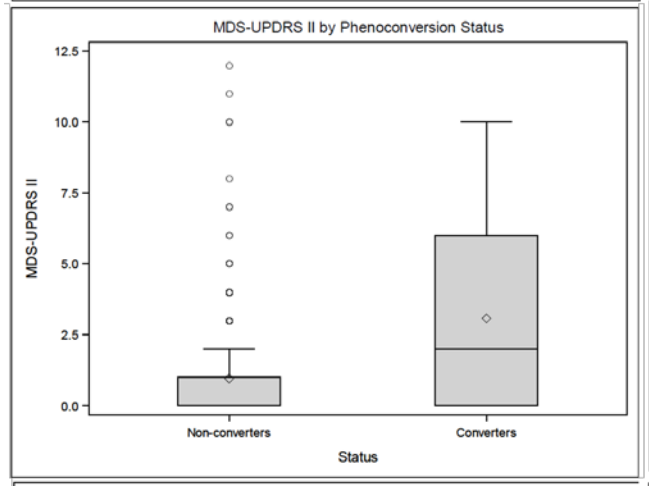
Variable	Non-Converters (N = 240)	Converters (N = 23)	p-value
Age			
Mean (SD)	62.57 (7.40)	68.74 (7.31)	**0.0007**
(Min, Max)	(33.72, 84.30)	(56.21, 82.53)	
Gender			
Male	109 (45.42%)	17 (73.91%)	**0.0090**
Female	131 (54.58%)	6 (26.09%)	
Smell Category			
Normosmia	99 (41.42%)	2 (8.70%)	**0.0021**
Hyposmia/Anosmia	140 (58.58%)	21 (91.30%)	
Missing	1	0	
MDS-UPDRS I			
Mean (SD)	4.86 (4.05)	7.57 (4.77)	**0.0059**
Median	4.00	8.00	
(Min, Max)	(0.00, 24.00)	(0.00, 17.00)	
MDS-UPDRS II			
Mean (SD)	0.96 (1.92)	3.09 (3.38)	**0.0004**
Median	0.00	2.00	
(Min, Max)	(0.00, 12.00)	(0.00, 10.00)	
MDS-UPDRS III			
Mean (SD)	2.23 (3.18)	6.35 (5.02)	**<.0001**
Median	1.00	6.00	
(Min, Max)	(0.00, 21.00)	(0.00, 17.00)	
Motor Asymmetry Index			
Mean (SD)	-0.03 (0.52)	-0.08 (0.53)	0.7458
Median	0.00	0.00	
(Min, Max)	(-1.00, 1.00)	(-1.00, 1.00)	
SCOPA-AUT			
Mean (SD)	8.30 (5.93)	13.83 (8.85)	**0.0073**
(Min, Max)	(0.00, 31.00)	(4.00, 38.00)	
Missing	2	0	
RBDSQ			
Mean (SD)	3.63 (2.90)	7.13 (3.68)	**0.0002**
(Min, Max)	(0.00, 12.00)	(1.00, 13.00)	
Missing	2	0	
GDS			
Mean (SD)	1.75 (2.44)	1.87 (2.16)	0.8090
(Min, Max)	(0.00, 12.00)	(0.00, 6.00)	
Missing	1	0	
MOCA			
Mean (SD)	26.73 (2.46)	25.91 (3.20)	0.2436
(Min, Max)	(14.00, 30.00)	(18.00, 30.00)	

CONVERTERS VS. NONCONVERTERS

Variable	Non-Converters (N = 240)	Converters (N = 23)	p-value
Dat Deficit			
Negative	163 (74.09%)	4 (17.39%)	**<.0001**
Positive	57 (25.91%)	19 (82.61%)	
Missing	20	0	
Putamen SBR			
Mean (SD)	2.14 (0.61)	1.18 (0.43)	**<.0001**
(Min, Max)	(0.86, 4.21)	(0.54, 2.25)	
Missing	20	0	
Striatum SBR			
Mean (SD)	2.55 (0.62)	1.61 (0.47)	**<.0001**
(Min, Max)	(1.17, 4.41)	(0.80, 2.56)	
Missing	20	0	
Putamen Asymmetry Index			
Mean (SD)	-0.00 (0.07)	0.04 (0.14)	0.1621
(Min, Max)	(-0.30, 0.28)	(-0.23, 0.32)	
Missing	20	0	
Striatum Asymmetry Index			
Mean (SD)	-0.00 (0.04)	0.02 (0.08)	0.2907
(Min, Max)	(-0.11, 0.18)	(-0.15, 0.18)	
Missing	20	0	
CSF a-synuclein			
Mean (SD)	1616.21 (659.81)	1372.27 (448.22)	
Median	1581.30	1323.20	0.1207
(Min, Max)	(398.80, 4325.50)	(589.20, 2522.80)	
Missing	156	4	
1 Year Change in a-Synuclein			
Mean (SD)	66.01 (285.75)	-46.62 (174.80)	
Median	43.00	-82.90	0.0886
(Min, Max)	(-573.50, 800.30)	(-314.20, 286.40)	
Missing	203	10	


Age by Phenoconversion Status
Age
90
80
70
60
50
40
30
Non-converters
Converters
Status


MDS-UPDRS I by Phenoconversion Status
MDS-UPDRS I
25
20
15
10
5
0
Non-converters
Converters
Status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MDS-UPDRS II
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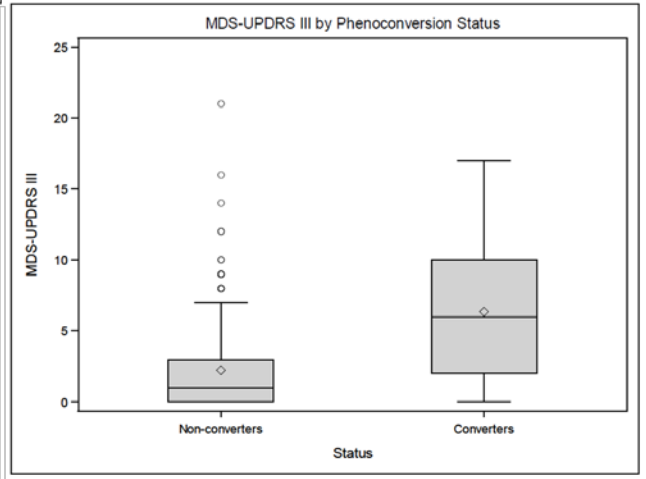
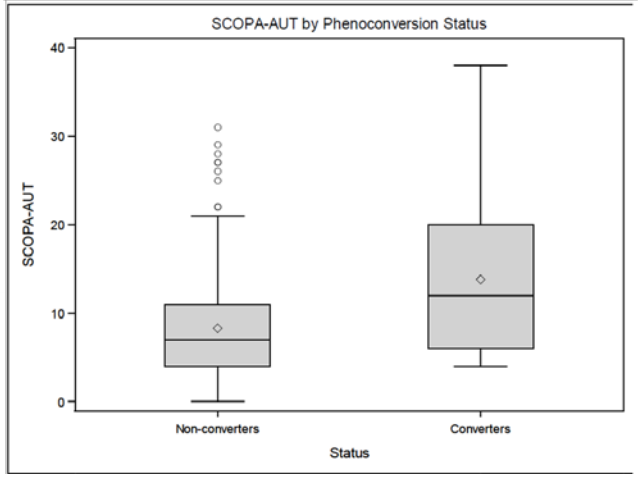
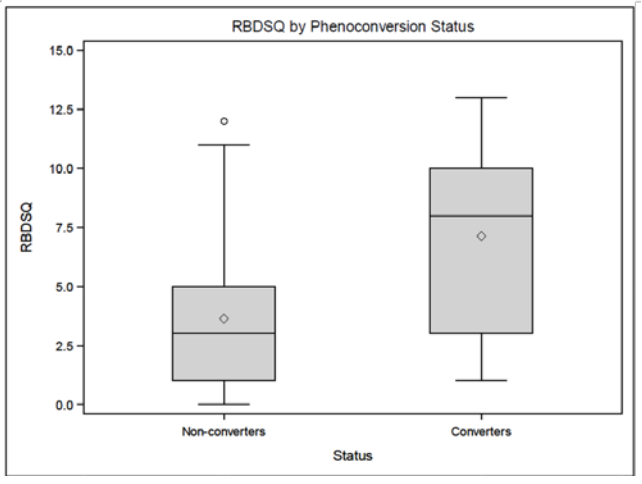
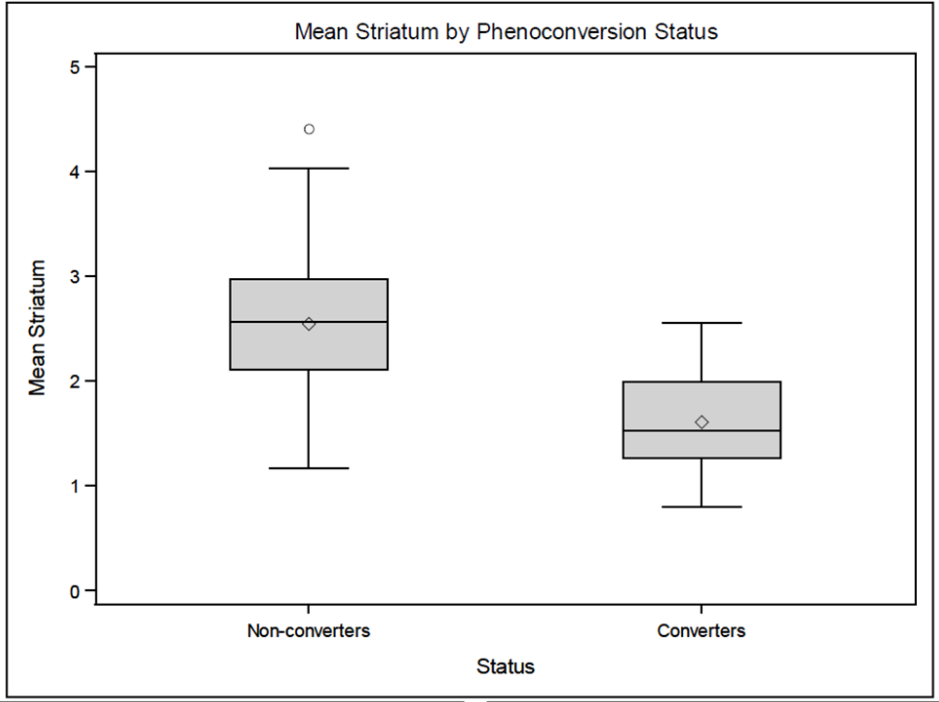
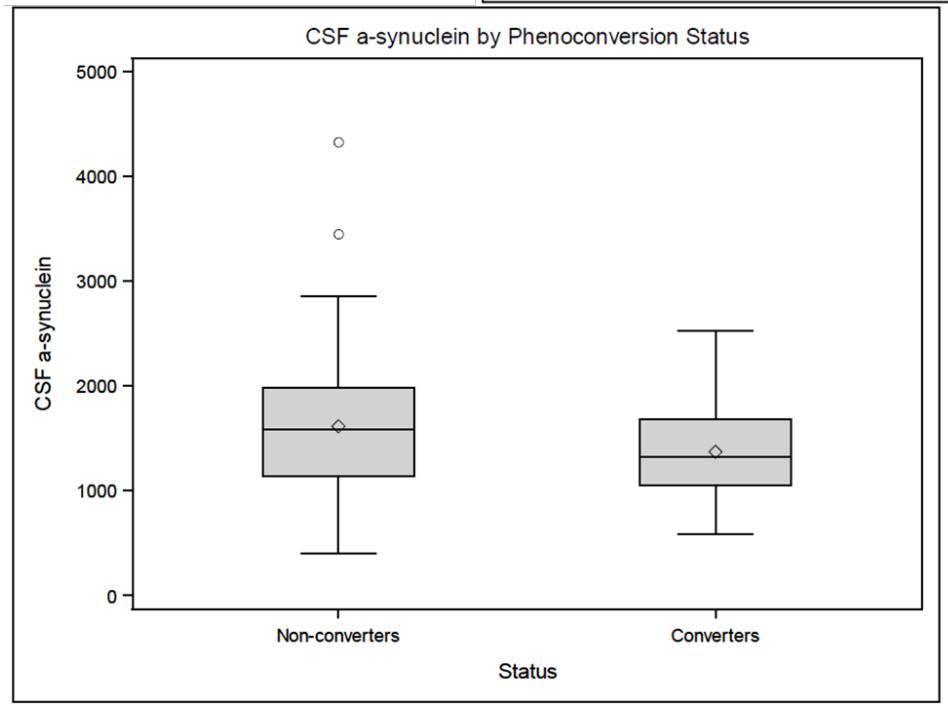
10.0
7.5
5.0
2.5
0.0
Non-converters
Converters
Status

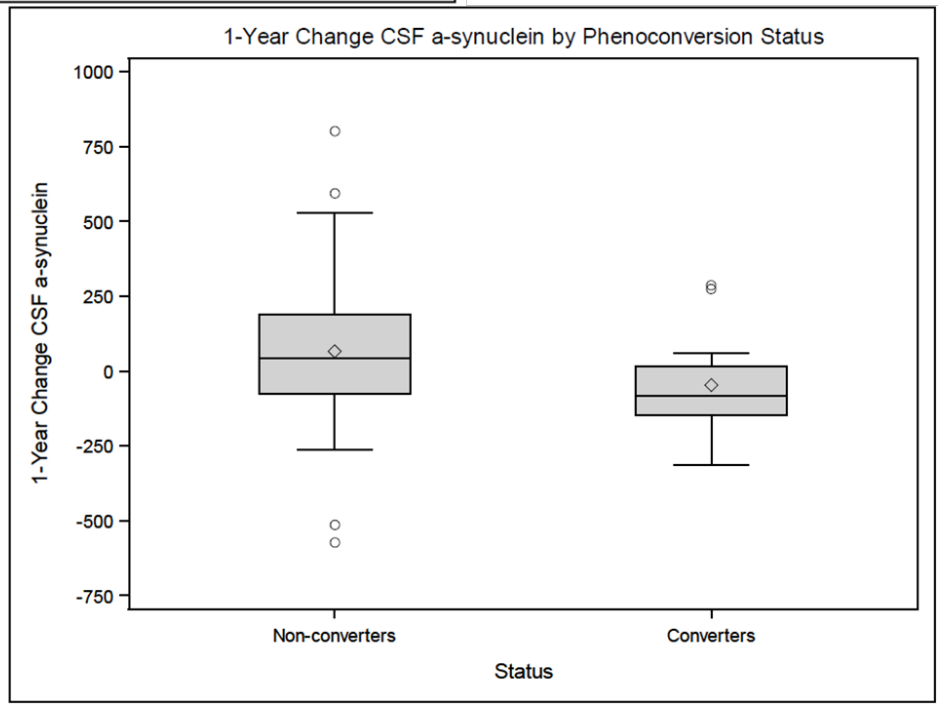

MDS-UPDRS III by Phenoconversion Status
MDS-UPDRS III
25
20
15
10
5
0
Non-converters
Converters
Status


SCOPA-AUT by Phenoconversion Status
SCOPA-AUT
40
30
20
10
0
Non-converters
Converters
Status


RBDSQ by Phenoconversion Status
RBDSQ
15.0
12.5
10.0
7.5
5.0
2.5
0.0
Non-converters
Converters
Status


Mean Striatum by Phenoconversion Status
Mean Striatum
5
4
3
2
1
0
Non-converters
Converters
Status


CSF a-synuclein by Phenoconversion Status
CSF a-synuclein
5000
4000
3000
2000
1000
0
Non-converters
Converters
Status


1-Year Change CSF a-synuclein by Phenoconversion Status
1-Year Change CSF a-synuclein
1000
750
500
250
0
-250
-500
-750
Non-converters
Converters
Status

SUMMARY

- Clinical features different between converters and non-converters include age, olfactory function, neuropsychiatric and autonomic symptoms, RBD and motor abnormalities

- Striatal SSBR at baseline is associated with conversion

- Total CSF α-syn is not associated with conversion, though perhaps change in CSF α-syn is of predictive value

CHARACTERISTICS OF PHENOCONVERTERS IN THE RBD COHORT

RBD CONVERTERS VS. NONCONVERTERS

- RBD cohort:
  - n=38
  - RBD symptom duration: mean 9.94 years (range 0.38-30.36 years)
  - RBD duration since diagnosis: mean 2.92 years (range 0.04-11.77)
  - Recruitment heavily stratified toward DaTscan SPECT deficit (~90%:~10%)

RBD CONVERTERS VS. NONCONVERTERS

- RBD cohort: 11 converters vs. 27 non-converters
  - Mean follow-up time 40.91 mo in converters vs. 37.33 mo in non-converters (p=0.047)
  - 7 converted to PD
  - 3 to DLB
  - 1 to MSA (first coded as PD then after 4 visits to MSA)

RBD CONVERTERS VS. NONCONVERTERS

Variable	Non-Converters (N = 27)	Converters (N = 11)	p-value
Age			
Mean (SD)	70.19 (6.08)	67.88 (3.64)	0.2738
Median	70.76	67.18	
(Min, Max)	(58.91, 81.82)	(61.80, 74.53)	
Gender			
Male	25 (92.59%)	7 (63.64%)	**0.0466**
Female	2 (7.41%)	4 (36.36%)	
Smell Category			
Normosmia	1 (3.85%)	0 (0.00%)	1.0000
Hyposmia/Anosmia	25 (96.15%)	11 (100.00%)	
Missing	1	0	
MDS-UPDRS I			
Mean (SD)	6.48 (3.40)	9.36 (4.61)	0.0649
Median	7.00	9.00	
(Min, Max)	(1.00, 13.00)	(1.00, 17.00)	
MDS-UPDRS II			
Mean (SD)	1.89 (2.28)	2.91 (3.42)	0.5281
Median	1.00	2.00	
(Min, Max)	(0.00, 7.00)	(0.00, 10.00)	
MDS-UPDRS III			
Mean (SD)	3.48 (3.06)	7.00 (4.54)	**0.0204**
Median	3.00	6.00	
(Min, Max)	(0.00, 12.00)	(2.00, 15.00)	
Motor Asymmetry Index			
Mean (SD)	-0.01 (0.64)	-0.05 (0.54)	1.0000
Median	0.00	0.00	
(Min, Max)	(-1.00, 1.00)	(-1.00, 1.00)	
SCOPA-AUT			
Mean (SD)	13.63 (7.38)	17.91 (9.68)	0.1861
Median	12.00	17.00	
(Min, Max)	(5.00, 31.00)	(4.00, 38.00)	
RBDSQ			
Mean (SD)	8.70 (3.15)	9.73 (2.65)	0.3622
Median	10.00	10.00	
(Min, Max)	(1.00, 12.00)	(4.00, 13.00)	
GDS			
Mean (SD)	2.67 (2.72)	3.00 (2.53)	0.6016
Median	2.00	3.00	
(Min, Max)	(0.00, 10.00)	(0.00, 6.00)	
MOCA			
Mean (SD)	25.78 (4.40)	24.82 (3.71)	0.2683
Median	27.00	25.00	
(Min, Max)	(11.00, 30.00)	(18.00, 30.00)	

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Normosmia	1 (3.85%)	0 (0.00%)	1.0000
Hyposmia/Anosmia	25 (96.15%)	11 (100.00%)	
Missing	1	0	
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Mean (SD)	6.48 (3.40)	9.36 (4.61)	0.0649
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(Min, Max)	(1.00, 13.00)	(1.00, 17.00)	
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(Min, Max)	(0.00, 12.00)	(2.00, 15.00)	
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Median	27.00	25.00	
(Min, Max)	(11.00, 30.00)	(18.00, 30.00)	

RBD CONVERTERS VS. NONCONVERTERS

Variable	Non-Converters (N = 27)	Converters (N = 11)	p-value
Dat Deficit			
Negative	3 (11.11%)	0 (0.00%)	0.5423
Positive	24 (88.89%)	11 (100.00%)	
Putamen SBR			
Mean (SD)	1.24 (0.31)	0.91 (0.25)	**0.0036**
Median	1.21	0.86	
(Min, Max)	(0.72, 1.99)	(0.54, 1.40)	
Striatum SBR			
Mean (SD)	1.66 (0.40)	1.27 (0.26)	**0.0051**
Median	1.60	1.26	
(Min, Max)	(0.97, 2.78)	(0.80, 1.67)	
Putamen Asymmetry Index			
Mean (SD)	0.02 (0.13)	0.04 (0.14)	0.7233
Median	0.01	0.01	
(Min, Max)	(-0.20, 0.31)	(-0.20, 0.31)	
Striatum Asymmetry Index			
Mean (SD)	0.01 (0.06)	0.00 (0.07)	0.9231
Median	0.01	-0.01	
(Min, Max)	(-0.11, 0.13)	(-0.15, 0.14)	
CSF a-synuclein			
Mean (SD)	1771.31 (923.32)	1305.23 (512.48)	
Median	1673.15	1222.40	0.1501
(Min, Max)	(398.80, 4325.50)	(589.20, 2522.80)	
Missing	3	0	
1 Year Change in a-synuclein			
Mean (SD)	68.63 (171.82)	1.43 (163.60)	
Median	65.90	-57.05	0.2330
(Min, Max)	(-249.20, 442.50)	(-185.80, 286.40)	
Missing	12	1	

SUMMARY

- Motor abnormalities are greater among converters; neuropsychiatric symptoms and autonomic symptoms worse

- Even among a group selected based on DaT binding, DaT measures are strongly associated with conversion

QUESTIONS/ COMMENTS