ONLINE SUPPLEMENT

Data Sources Used to Screen for PD

1. **CMS Outpatient Claims:** We screened CMS data screened for both in-patient hospitalizations (included as part of the original algorithm) as well as out-of-hospital PD-related billing associated with out-patient physician visits, skilled nursing facilities, hospice care and post-acute home healthcare. All PD-related claims were extracted from 1991 through 2006:
    a. Number of claims physicians filed for the ICD-9 codes 332.x and 332.0: We used the number of claims filed for 332.0 to calculate the proportion of claims of 332.X (i.e., primary/idiopathic PD and secondary parkinsonism) that were specifically for 332.0 (i.e., primary/idiopathic PD).
    b. Specialty of the physician filing the claim: We documented whether the claims were associated with a neurologist.
    c. Eligibility for CMS FFS: For each participant we reviewed information regarding periods of enrolment in FFS found. Eligibility files, which contain information on program eligibility and enrollment during the time period covered by the claims, are generated annually even if no claims were received in a given year.[32] Claims are only recorded when participants are enrolled in FFS. Because participants may transition between enrollment and disenrollment in CMS, we considered duration of eligibility in CMS a potential confounder. We calculated the total number of years a participant was eligible for CMS FFS and the number of years they were eligible after their first indication of PD.

2. **Updated CHS Follow-up Data:** We extended our original case ascertainment to include additional follow-up through the 2006-2007 examination. During this interval, self-report of PD was available from the 2005-2006 examination in addition to a search for new anti-parkinsonian medications documented as part of the annual medication inventory, and for ICD-9 code of 332.0 from hospitalizations.
3. **Causes of Death:** All fatal events in CHS are adjudicated by a study-wide Mortality Review Committee, which classifies the specific-cause of death based on the review of information from death certificates, autopsy reports (if available), hospital records, interviews with attending physicians, next-of-kin, and witnesses.[15] We screened specifically for PD as an adjudicated cause of death.
4. **Medical Records from Hospitalizations:** In CHS, medical records from hospitalizations were available to review for evidence of PD. Authors (SJ and SH) reviewed medical records of participants with any indication of PD from any of the above data sources for the following clinical information: any evidence of PD found in the admission history and physical or discharge summary including history of present illness, past medical history, medications, physical exam or discharge diagnoses. In addition, any evidence of other forms of parkinsonism were recorded (e.g. drug-induced Parkinsonism, atypical Parkinsonism).

Adjudication for PD

We implemented a formal adjudication process to evaluate all potential PD cases who were screened positive for PD on the basis of self-report, medication use, ICD-9 hospitalization diagnosis code, cause of death, or CMS FFS claim. As part of the adjudication process, we excluded all potential cases of drug-induced parkinsonism, defined as use of a potential

parkinsonism-inducing medication before the date of first evidence of PD. We used the same medication list that was compiled during the development of our original case ascertainment method.[16] To classify PD, two movement disorders specialists (SJ, SH) independently evaluated data from CHS (i.e., self-report, medications, ICD-9), medical records from hospitalization (i.e., endorsement of PD, clear evidence against PD), adjudicated causes of deaths (i.e., PD-specific cause of death), and CMS FFS (i.e., proportion of claims of 332.X that were 332.0, physician specialty, years of eligibility in CMS, years of eligibility in CMS after first PD evidence). The proportion of 332.x claims (corresponding to secondary parkinsonism and idiopathic PD) that were specifically billed as PD (332.0) provided reviewers with a measure of certainty. Proportions closer to 1.0 provided reviewers with greater certainty about a PD diagnosis since most or all 332.x claims would be specifically linked to idiopathic PD (332.0). Furthermore, we distinguished whether a neurologist or other types of specialists submitted claims; those submitted by a neurologist provided greater credibility of a PD diagnosis. The two reviewers discussed all conflicting assignments until they achieved a final consensus. Final adjudicated assignments were: (1) Probable PD, (2) Possible PD, and (3) Not PD. The criteria used to adjudicate potential PD outcomes and selected examples are summarized in online Table A.

Online Table A. Use of various data sources for original PD case identification and enhanced PD case identification in the Cardiovascular Health Study, 1989-2007.

	PD case identification	
Data source	Original*	Enhanced
Participant self-report from CHS	Exam 1990/1991 (original cohort) Baseline 1992 (AA cohort) 1998 exam (both cohorts)	Exam 1990/1991 (original cohort) Baseline 1992 (AA cohort) 1998 exam (both cohorts)
Anti-parkinsonian medication from CHS	Baseline through 2001	Baseline through 2007
ICD-9 codes from CMS billing records		
Hospitalization discharge (Part A)	Baseline through 2001	Baseline through 2007
Skilled nursing, hospice, and post-acute home healthcare (Part A)	---	1991 through 2007
Outpatient claims (Part B)	---	1991 through 2007
Adjudicated cause of death from CHS	---	Baseline through 2007
Medical record review of hospitalizations from CHS	---	Baseline through 2007

* As described in Ton TG, et al. Neuroepidemiology. 2010;35:241-249

Online Table B. Adjudication Status, Criteria and Examples

Status	Criteria
Not PD*	Any one of the following: a. No suggestion of PD from any source b. There is evidence of exposure to medications which may result in Parkinsonism prior to or at the same time as the first evidence of PD (drug-induced Parkinsonism) c. Another diagnosis which may be mistaken as PD (e.g., Atypical parkinsonism, tremor, dystonia) apparent upon review of the chart d. The only evidence of PD is a single CMS outpatient distinct visit and that claim is not made by a neurologist e. The pattern of CMS claims is not consistent with PD
Possible PD	Does not meet criteria for "Not PD", AND any one of the following: a. Data sources evidence suggests Parkinsonism, but there is insufficient or conflicting evidence to adjudicate on PD status i. Only CMS data and no CHS data suggests PD and there is > 1 non-neurologist CMS outpatient distinct visit claim of PD (332.0) ii. If CHS data suggests PD and CMS data is available and not supportive of PD iii. < 70% of all 332.x CMS outpatient distinct visits were 332.0
Probable PD	Does not meet criteria for either "Not PD" nor "Possible PD", AND any one of the following: a. At least 2 sources supportive of PD b. If cause of adjudicated death is PD c. If the only source is CMS ICD-9 outpatient distinct visits, the pattern of claims (number of distinct visits, provider type, proportion of 332.0), given the period of capture in Medicare fee-for-service, is consistent with PD diagnosis d. A single source of CHS data suggesting PD AND no period of capture in Medicare fee for service available.
*reasons for which individuals were ruled out included evidence in medical charts of parkinsonism, essential tremor, dystonia, Lewy-body disease, atypical parkinsonism from normal pressure hydrocephalus, restless leg syndrome, normal pressure hydrocephalus.	

Online Table C. Comparing new enhanced case ascertainment method to original algorithm used to identify individuals with PD in the CHS.

		New Method Incorporating CMS data and Adjudication Process		
		PD	No PD	
Original Algorithm	PD	134	80	214
	No PD	75	5599	5674
		209	5679	5888
	*McNemar's test: p=0.7 *Pearson's chi-square test: p<0.001 *kappa statistic: p<0.001			

Online Table D. Magnitude of Residual Confounding by Time Eligible in CMS Through Comparison of Associations from two Multivariate Logistic Models of incident PD and Baseline Smoking Characteristics, Cardiovascular Health Study, 1989-2006.

	Current Adjudication									
	Crude Distribution				Model 1*			Model 2**		
	PD		no PD							
Characteristic	n=165	(%)	n=5679	(%)	OR**	95% CI	P-value[a]	OR‡	95% CI	P-value[a]
Smoking Status							0.021			0.009
Never	80	(48.5)	2634	(46.4)	1.00	Reference		1.00	Reference	
Former	74	(44.9)	2297	(40.5)	0.85	(0.61, 1.19)		0.83	(0.59, 1.16)	
Current	11	(6.7)	742	(13.1)	0.45	(0.24, 0.86)		0.42	(0.22, 0.79)	
Years since quitting							0.014			0.005
Never smoker	80	(49.4)	2634	(47.0)	1.00	Reference		1.00	Reference	
≥ 30 years	23	(14.2)	604	(10.8)	0.99	(0.61, 1.61)		0.99	(0.61, 1.61)	
20-29	21	(13.0)	560	(10.0)	0.97	(0.58, 1.61)		0.96	(0.58, 1.58)	
10-19	12	(7.4)	585	(10.4)	0.56	(0.30, 1.04)		0.54	(0.29, 1.00)	
>1-10	15	(9.2)	477	(8.5)	0.88	(0.50. 1.56)		0.84	(0.48, 1.48)	
Current smoker	11	(6.8)	742	(13.3)	0.45	(0.24, 0.87)		0.42	(0.22, 0.79)	
Cigarettes per day[b]							0.040			0.019
Never smoker	80	(50.3)	2634	(47.5)	1.00	Reference		1.00	Reference	
<10	16	(10.1)	624	(11.2)	0.81	(0.47, 1.40)		0.80	(0.46, 1.38)	
10-19	23	(14.5)	802	(14.4)	0.83	(0.52, 1.34)		0.81	(0.51, 1.31)	
20-28	29	(18.2)	935	(16.5)	0.79	(0.51, 1.25)		0.76	(0.48, 1.19)	
≥ 29	11	(6.9)	559	(10.0)	0.48	(0.25, 0.93)		0.45	(0.51, 1.31)	
Total pack-years							0.013			0.005
Never smoker	80	(50.6)	2634	(48.0)	1.00	Reference		1.00	Reference	
1st quartile (0-13)	29	(18.4)	829	(15.1)	0.99	(0.64, 1.53)		0.99	(0.64, 1.54)	
2nd quartile (14-27)	17	(10.8)	643	(11.7)	0.74	(0.43, 1.26)		0.72	(0.42, 1.24)	
3rd quartile (28-49)	13	(8.3)	505	(9.2)	0.67	(0.27, 1.23)		0.65	(0.36, 1.20)	
4th quartile (≥ 50)	19	(12.0)	880	(16.0)	0.55	(0.33, 0.94)		0.51	(0.30, 0.85)	

*Model 1: Adjusted for age, sex, African American race, education, and total time eligible for CMS

**Model 2: Adjusted for age, sex, African American race, education

† Incident PD = 154, as described in reference 2; ‡Adjusted for age, sex, African American race.

[a]Test for linear trend

[b] Results for cigarettes/day not published in original paper