

## Appendix 1. Search Strategy

### Medline (PubMed)

("Suicide"[Mesh] or suicid\*[tiab] or parasuicid\*[tiab]) AND  
("Parkinson Disease"[Mesh] OR "Parkinson's disease"[tiab] OR  
"Parkinson disease"[tiab] OR "Parkinsons disease"[tiab])

### Embase

('Parkinson disease'/exp OR 'Parkinson disease':ti,ab OR 'Parkinsons disease':ti,ab) AND ('suicide'/exp OR suicid\*:ti,ab or parasuicid\*:ti,ab)

### The Cochrane Library (Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials (CENTRAL), Cochrane Methodology Register),

> Search Name:

> Date Run: 14/02/17 19:14:18.678

> Description:

>

> ID Search Hits

> #1 MeSH descriptor: [Suicide] explode all trees 755

> #2 MeSH descriptor: [Parkinson Disease] explode all trees 2647

> #3 suicid\* or parasuicid\*:ti,ab,kw 2764

> #4 "Parkinson's disease" or "Parkinson disease" or "Parkinsons disease":ti,ab,kw 5162

> #5 #1 or #3 2764

> #6 #2 or #4 5162

> #7 #5 and #6 25

### PsycInfo (Ebsco)

(DE "Attempted Suicide" OR DE "Suicide" OR suicid\* or parasuicid\*) AND (DE "Parkinson's Disease" OR "Parkinson's disease" OR "Parkinson disease" OR "Parkinsons disease")

### Web of Science (Science and Social Science Citation Index).

TS=((suicid\* or parasuicid\*) AND ("Parkinson's disease" OR "Parkinson disease" OR "Parkinsons disease"))

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Revised search: Run on 3/26/2018

Searched from 2/14/2017-3/26/2018

### Initial search

PubMed: 206  
 Embase: 482  
 PsycInfo: 149  
 Web of Science: 307  
 Cochrane: 25  
 Total: 1169  
 Duplicates: 434

**Final total: 735**

**Revised search**

PubMed: 13  
 Embase: 56  
 PsycInfo: 7  
 Web of Science: 24  
 Cochrane: 0  
 Total: 100  
 Duplicates: 25

**Final total: 75**

Appendix 2. Summary of Articles Reviewed by Topic. For those articles in which the study location was not reported they were marked “Unspecified” followed by the location of the author’s home institutions. N/A= not applicable.

	First Author	Date	Study Design	Location	Population	Study Duration	Relevant Findings	Quality	Comments
Prevalence and Risk of Attempted and Fatal Suicide in Parkinson’s Disease (PD)	Ahmedani	2017	Case-control	United States	2,674 suicide victims and 267,400 controls	N/A	-PD associated with sex and age adjusted OR for suicide of 1.87 (95% CI 1.20-2.91), p= 0.006. -Lost significance after adjustment for mental illness, substance use.	3	
	Dumitru	2016	Cross-sectional	Unspecified-Romania	109 Persons with Parkinson’s disease (PwP)	N/A	-Prior suicide attempt (SA) = 5.5%.	2	Abstract.
	Eliassen	2018	Case-control	Netherlands	8974 persons with SA via poisoning 89,740 controls	N/A	-SA via poisoning and PD = OR 2.9, 95% CI (1.8-4.6).	3	SAs determined by identifying cases reported to the Danish Poison Information Center.
	Hoehn	1967	Prospective cohort	United States	802 neurology clinic outpatients with a diagnosis of paralysis agitans, PD or parkinsonism	15 years	-293 decedents with PD, 3 died by suicide.	2	Not noted whether the patients who died by suicide had PD, secondary, or indeterminate parkinsonism.
	Jones	2012	Retrospective	British	768,827 individuals over age 65	10 years	-10,910 incidence cases of PD.	3	

			cohort	Columbia			-Suicide = second major cause of injury-related deaths in PD (7.7%).		
	Juurlink	2004	Case-control	Canada	1329 suicide victims age 66 or older 5315 matched controls	9 years	-No association between PD and suicide	3	PwP identified by prescription record. Patients prescribed levodopa, bromocriptine, selegiline, ropinirole or pramipexole 6 months prior to death were presumed to have a diagnosis of PD.
	Kostic	2010	Prospective cohort study followed by cross-sectional study	Serbia	102 outpatients with PD for cohort study 128 outpatients with PD for cross-sectional study	8 years	-Suicide in 2 patients. -Suicide rate = 5.3x expected for age, sex-matched population.	2	Did not control for levodopa dose.
	Kummer	2009	Cross-sectional	Brazil	90 non-demented outpatients with PD in a Movement Disorders Clinic.	N/A	-No SAs.	2	
	Lee	2016	Prospective cohort followed by case-control analysis	South Korea	4362 neurology clinic outpatients with PD	16 years	-29 suicides (19 males and 10 females) over a mean of 7.1 years. -RR = 1.99 (95% CI=1.33-2.85)	3	
	Lee	2018	Retrospective cohort	South Korea	300,232 individuals 725 suicides	12 years	-9 (1.24%) PwP died by suicide -Elevated at-risk adjusted rate of suicide after Bonferroni correction.	3	
	Mainio	2009	Cross-sectional	Northern Finland	555 suicide victims over age 50	N/A	-PD in 1.6%	3	
	Marttila	1977	Prospective cohort	Finland	349 PwP on levodopa.	6 years	-61 decedents with PD, 1 died by suicide.	3	
	Myslobodsky	2001	Prospective cohort	United States	144,364 PwP	5 years	-Suicide rate = 0.08% in PD versus 0.8% in the general population.	3	
	Nazem	2008	Cross-sectional	United States	116 outpatients with PD	N/A	-Prior SA = 4%	3	
	Negre-Pages	2009	Prospective cohort	France	329 PwP 73 controls without PD	24 months	-Suicide in 1% of PwP.	2	Abstract.
	Ozdilek	2014	Cross-sectional	Turkey	120 PwP	N/A	-No SAs	2	All participants identified their religion as Muslim. Multivariate analyses were run but were not reported.
	Rai	2015	Cross-sectional	India	126 PwP without dementia	N/A	-No SAs	3	"Suicidal risk" was determined by the Mini-International Neuropsychiatric Interview and classified as mild, moderate or severe based on intentionality and behaviors.
	Roberts	2017	Retrospective cohort	England and Wales	11,004,389 acute hospital admissions in England and 713,496 in Wales	1 year	-In England: 15, 997 admitted for PD, 9 suicides. Standardized mortality ratio (SMR)= 5.6 (CI 2.5-9.9). -In Wales: 1321 admitted for PD, no suicides	3	
	Stenager	1994	Prospective cohort	Denmark	458 PwP	17 years	-2/254 patients died by suicide. -Expected = observed suicide rate	3	Limited information given on suicide victims.
	Stensman	1988	Case-control	Sweden	416 suicide victims	7 years	-Expected one PD suicide, observed four. Significant even with adjustment for age.	2	To calculate expected suicide rates, used prevalence figures from Finland. Did not adjust for sex. Undetermined causes of death were excluded.
	Willis	2016	Cross-sectional	United States	3,918,703 hospitalizations for mental illness or substance use	N/A	-104,437 hospitalizations involved PwP. -Hospitalization for suicidal ideation (SI) or SA = 0.84% for PwP versus 0.99% for controls -Adjusted OR = no significant difference between groups.	3	
Prevalence and Risk of SI in PD	Akbostanci	2017	Case-control	Unspecified-Turkey	100 PwP 100 matched controls	Unspecified	-Suicide Probability Scale (SPS) scores significantly lower in PwP versus controls. -No difference in Beck Depression Inventory (BDI) scores.	2	Abstract. Controls had a significantly higher MMSE score. Excluded patients with MMSE score < 24. Unclear where healthy controls were obtained and whether they were screened for depression or other mental illness. Controls matched for age, sex, years of education and marital status.
	Kummer	2009	Cross-sectional	Brazil	90 non-demented outpatients with PD in a Movement Disorders Clinic	N/A	-SI = 14.4%	2	
	Brown	1990	Cross-sectional	England	40 PwP	N/A	-No SI.	1	Participants selected from a larger cohort; selection criteria unclear. 20 identified patients did not agree to study. No information given on these patients.
	Dumitru	2016	Cross-sectional	Unspecified-Romania	109 PwP	N/A	-Death ideation/SI in 31%	2	Abstract.
	Dumitru	2016	Cross-sectional	Unspecified-	58 outpatients with PD	N/A	-Death ideation in 27.6%.	1	Abstract.

				Romania			-SI in 12%.		
	Dissanayaka	2010	Cross-sectional	Australia	79 outpatients with PD	N/A	-SI in 4%	1	114 patients met inclusion criteria but only 79 patients completed the study.
	Nazem	2008	Cross-sectional	United States	116 outpatients with PD	N/A	-Death ideation/SI in 30%.	3	
	Ozdilek	2014	Cross-sectional	Turkey	120 PwP	N/A	-Lifetime SI = 11.6%.	2	All participants identified their religion as Muslim. Multivariate analyses were run but were not reported.
	Rai	2015	Cross-sectional	India	126 PwP without dementia.	N/A	-“Suicidal risk” = 31% of patients.	3	“Suicidal risk” was determined by the Mini-International Neuropsychiatric Interview and classified as mild, moderate or severe based on intentionality and behaviors.
	Rezvani	2017	Cross-sectional	Unspecified-United States	1783 PwP	N/A	-SI =18%	2	Abstract.
	Stensman	1988	Case-control	Sweden	416 suicide victims	7 years	-Expected one PD suicide, observed four. Remained significant with adjustment for age.	2	To calculate expected suicide rates, used prevalence figures from Finland. Did not adjust for sex. Undetermined causes of death were excluded.
	Willis	2016	Cross-sectional	United States	3,918,703 hospitalizations for mental illness or substance use	N/A	-104,437 hospitalizations involved PwP. -Hospitalization for SI or SA = 0.84% for PwP versus 0.99% for controls -Adjusted OR = no significant difference between groups.	3	
Suicide Methods in PD	Burkhard	2004	Prospective cohort	Unspecified-Switzerland	140 persons with a variety of movement disorders treated with Deep Brain Stimulation (DBS).	9 years	-2 suicides by defenestration -1 suicide by drug overdose	2	Unclear how many of the total cohort had a diagnosis of PD. Authors classified assisted-death/euthanasia as suicide.
	Bridgeman	2017	Case report	United States	49-year-old man with PD with DBS in place.	N/A	-SA via overdose on citalopram.	0	Abstract. No other information given on PD diagnosis or DBS
	Eliassen	2018	Case-control	Netherlands	8974 persons with SA via poisoning 89,740 controls	N/A	-SA via poisoning and PD = OR 2.9, 95% CI (1.8-4.6).	3	SAs determined by identifying cases reported to the Danish Poison Information Center.
	Juurlink	2004	Case-control	Canada	1329 suicide victims over age 66 and matched controls	9 years	-No association between PD and suicide -PwP significantly more likely to commit suicide by suffocation compared to suicide victims in the general population (20% versus 6%, p= .004)	3	Identified cases of PD by analyzing prescription records. Patients prescribed levodopa, bromocriptine, selegiline, ropinirole or pramipexole were presumed to have a diagnosis of PD.
	Lorenzl	2017	Case series	Switzerland	72 individuals with parkinsonism who completed assisted-death between 2006-2012	N/A	-53% had an atypical parkinsonian disorder. -Described extent of family support and motivations behind assisted-suicide.	0	Abstract
	Mainio	2009	Case-control	Finland	555 suicide victims over age 50	14 years	-Suicide victims with PD were most likely to use a violent method.	3	
	Santos-Garcia	2009	Case series	Unspecified-Spain	9 patients treated with Levodopa-carbidopa intestinal gel (LCIG).	N/A	-1 suicide by hanging 3 months after starting LCIG.	0	Abstract
	Schüpbach	2007	Prospective cohort	France	171 PwP with severe levodopa-related motor symptoms who underwent subthalamic nucleus (STN)-DBS	9 years	-1 suicide by hanging.	3	All patients had severe levodopa-related motor complications. Patients excluded if over 75, active severe psychiatric illness or dementia.
	Tir	2007	Prospective cohort	France	100 PwP after STN-DBS	12 months	-2 suicides by hanging.	2	
Anatomy, Physiology and Biomarkers	Stankovic	2014	Cross-sectional	Unspecified- Serbia	120 PwP	N/A	-Depressed PwP with non-hypogenic raphe had more frequent SI.	2	Abstract. 39% of the sample was depressed. Controls were unmatched. Unclear definition of reduced echogenicity.
	Wang	2013	Prospective cohort study	Unspecified-China	6 PwP and 6 controls pre- and post-DBS.	1 week	-One SA in PwP group 8 months after starting DBS. -SI resolved after stopping DBS -Noted to have decreased extracellular superoxide dismutase and tetranectin	1	Incidental finding.
Demographic Risk Factors	Kostic	2010	Prospective cohort study followed by cross-sectional study	Serbia	102 outpatients with PD for cohort study 128 outpatients with PD for cross-sectional study	8 years	-Older age associated with SI on univariate analysis.	2	Did not control for levodopa dose.
	Kummer	2009	Cross-sectional	Brazil	90 non-demented outpatients with PD in a Movement Disorders Clinic	N/A	-Gender, marital status, education level not associated with SI. -Younger age associated with SI on univariate analysis.	2	
	Lee	2016	Prospective cohort followed by case-control analysis	South Korea	4362 neurology clinic outpatients with PD	16 years	-Suicide significantly associated with male gender.	3	
	Li	2018	Case-control	Singapore	10 suicide victims with PD 30 PwP who died from other causes.	10 years	-Suicide victims with PD were younger with fewer comorbidities than PwP who died from other causes. -Suicide victims with PD had a trend towards being more likely to be male, but this was not significant. -Education, marital status not significantly different between groups.	1	Information on comorbidities could have been obtained anytime within two years prior to death.
	Myslobodsky	2001	Prospective cohort	United States	144,364 PwP	5 years	-Suicide victims with PD more likely to be Caucasian, male, reside in a rural area, younger compared to PwP who did not die	3	

							by suicide. -Suicide victims with PD were more likely to be married than suicide victims from the general population. -No difference in education level compared to victims in the general population.		
	Rezvani	2017	Cross-sectional	Unspecified-United States	1783 PwP	N/A	-SI correlated with younger age, more comorbidities.	2	Abstract.
Neuropsychiatric Symptoms and Suicide	Aykaç	2013	Cross-sectional	Unspecified- Turkey	102 PwP 75 age and sex-matched controls	N/A	- No association between akathisia and suicide.	2	Abstract.
	Dumitru	2016	Cross-sectional	Unspecified-Romania	109 PwP	N/A	-SI correlated with severity of depressive symptoms, psychosis and h/o impulse control disorder (ICD) behaviors. -No association of SI with severity of PD, motor symptoms, or cognition.	2	Abstract.
	Dumitru	2016	Cross-sectional	Unspecified-Romania	58 outpatients with PD.	N/A	-Severity of depression, ICD and psychosis were associated with SI or death ideation on univariate analysis. -Only severity of depression remained significant on multivariate analysis.	1	Abstract.
	Kostic	2010	Prospective cohort study followed by cross-sectional study	Serbia	102 outpatients with PD for cohort study 128 outpatients with PD for cross-sectional study	8 years	-Depression, higher scores on MMSE, Hamilton Rating Scale for Depression, Hamilton Rating Scale for Anxiety, Scale for Suicidal Ideation, Beck Hopelessness Scale and psychosis associated with SI on univariate analysis. -Only severity of depression, psychosis and higher scores on Beck Hopelessness Scale remained associated on multivariate analysis.	2	Did not control for levodopa dose.
	Kummer	2009	Cross-sectional	Brazil	90 non-demented outpatients with PD in a Movement Disorders Clinic	N/A	-Depression, BDI score, Hamilton Rating Scale for Depression score, panic disorder, and social anxiety disorder associated with SI on univariate analysis. -Only major depression remained significant after logistic regression. (OR =35.083, p=0.002).	2	
	Lee	2016	Prospective cohort followed by case-control analysis	South Korea	4362 neurology clinic outpatients with PD	16 years	-Suicide associated with depressive disorders, delusions, and any psychiatric disorder on univariate analysis. -After adjusting for age and sex, depressive disorders and any psychiatric disorder remained significant. -After adjusting for all other variables with backwards elimination, only history of psychiatric disorder remained significant.	3	
	Li	2018	Case-control	Singapore	10 suicide victims with PD 30 PwP who died from other causes.	10 years	- PwP who died by suicide were not more likely to have depression than PwP who died from other causes.	1	Depression retrospectively diagnosed by reviewers based on clinical history, use of antidepressants, and scores on past Unified Parkinson Disease Rating Scales (UPDRS). These could be obtained anytime within two years prior to death.
	Mainio	2009	Case-control	Finland	555 suicide victims over age 50	14 years	-Suicide victims with PD significantly more likely to have prior SA (44%) compared to suicide victims without PD (9.9%). - 44.4% of suicide victims with PD had depression, 55.6% had any psychiatric disorder (similar to rates in suicide victims without PD). - Alcohol contributed in 22.2% suicides in PwP (similar to rates in suicide victims without PD).	3	
	Myslobodsky	2001	Prospective cohort	United States	144,364 PwP	5 years	-Suicide victims with PD had higher rates of affective disorders than PwP who died of other causes (27.87% versus 1.13%).	3	
	Nazem	2008	Cross-sectional	United States	116 outpatients with PD	N/A	-Severity of depression, ICD, and psychosis associated with SI on univariate analysis. -Only severity of depression remained significant on multivariate analysis (OR= 2.76, 95% CI 1.88-4.07, P< 0.001).	3	
	Ozdilek	2014	Cross-sectional	Turkey	120 PwP	N/A	-Depression, ICD associated with SI.	2	All participants identified their religion as Muslim. Multivariate analyses were run but were not reported.
	Rai	2015	Cross-sectional	India	126 PwP without dementia	N/A	-92.3% of those with "suicidal risk" had depression (OR=42.9), 59% had anxiety (OR=4.3). -Only depression remained associated on multivariate analysis.	3	"Suicidal risk" was determined by the Mini-International Neuropsychiatric Interview and classified as mild, moderate or severe based on intentionality and behaviors.
	Rezvani	2017	Cross-sectional	Unspecified-United States	1783 PwP	N/A	-PwP and SI significantly more depressed, more likely to have a diagnosis of mood disorder than PwP who did not have SI.	2	Abstract.
	Sauvaget	2011	Prospective cohort	France	70 PwP who filled out a	2 years	-No suicides	1	Abstract. Sample size was likely too small to

					screening form prior to undergoing DBS				determine if survey was effective. There was no control group. Limited information given on what was included in the screening form and how this might differ from standard pre-operative screening.
	Starkstein	2008	Cross-sectional	Argentina	173 PwP	N/A	-SI, along with all other DSM-IV criteria for MDD, significantly associated with DSM-IV depressed mood criterion.	3	
	Starkstein	2011	Cross-sectional	Argentina	259 outpatients with PD treated at tertiary care centers	N/A	-SI, along with all other DSM-IV criteria for MDD, identified PwP with severe depression.	3	
Cognition as a Risk Factor	Kostic	2010	Prospective cohort study followed by cross-sectional study	Serbia	102 outpatients with PD for cohort study 128 outpatients with PD for cross-sectional study	8 years	-Higher MMSE scores associated with SI on univariate but not multivariate analysis.	2	Did not control for levodopa dose.
	Kummer	2009	Cross-sectional	Brazil	90 non-demented outpatients with PD in a Movement Disorders Clinic	N/A	-No association between MMSE scores and SI.	2	Patients were excluded from the study if they met criteria for dementia as defined by DSM-IV or MMSE.
	Li	2018	Case-control	Singapore	10 suicide victims with PD 30 PwP who died from other causes.	10 years	-PwP who died by suicide had significantly higher scores on the MMSE than those who died from other causes.	1	MMSE scores could have been obtained anytime within two years prior to death.
	Rezvani	2017	Cross-sectional	Unspecified-United States	1783 PwP	N/A	-PwP with SI significantly more cognitively impaired than PwP without SI (Montreal Cognitive Assessment Score 22.9 versus 24.7)	2	Abstract.
Motor Symptoms and Other PD-Related Variables as Risk Factors	Akbostanci	2017	Case-control	Unspecified-Turkey	100 PwP 100 matched controls	Unspecified	-Weak correlation between suicidality and disease duration. -BDI scores did not change with Hoehn & Yahr (H&Y) stage, however suicidality increased with increasing H&Y stage.	2	Abstract. Controls had a significantly higher MMSE score. Excluded patients with MMSE score < 24. Unclear where healthy controls were obtained and whether they were screened for depression or other mental illness. Controls matched for age, sex, years of education and marital status.
	Hinkle	2018	Cross-sectional	United States	223 PwP	N/A	-PwP who perceived motor fluctuations as being untreated significantly more likely to report SI compared to those with no motor fluctuations or treated motor fluctuations.	3	
	Kanda	2008	Cross-sectional	Japan	58 outpatients with PD 26 outpatients with spinocerebellar degeneration	N/A	-SI on the Zung's Self-Rating Depression Scale associated with UPDRS items measuring gait disturbance and posture on factor analysis.	2	
	Koerts	2008	Cross-sectional	Unspecified-Netherlands	43 depressed PwP	N/A	-SI associated with motor severity, specifically bradykinesia, rigidity and axial impairment. -SI not associated with tremor. -Association between SI and motor severity remained after Bonferroni correction.	2	As a group, these individuals scored lower than expected on a scale measuring suicidal thoughts.
	Kummer	2009	Cross-sectional	Brazil	90 non-demented outpatients with PD in a Movement Disorders Clinic.	N/A	-Earlier disease onset associated with SI on univariate analysis only.	2	
	Lee	2016	Prospective cohort followed by case-control analysis	South Korea	4362 neurology clinic outpatients with PD	16 years	-Association between suicide and initial extremity of motor symptom onset. -No association between suicide and UPDRS motor score, H&Y stage, duration of illness.	3	
	Li	2018	Case-control	Singapore	10 suicide victims with PD 30 PwP who died from other causes.	10 years	-PwP who died by suicide had lower H&Y stage and lower UPDRS motor scores than PwP who died from other causes. -Motor fluctuations more frequent in PwP who died by suicide, but this difference was not significant.	1	UPDRS motor scores and H&Y scores could have been obtained anytime within two years prior to death.
	Nikitina	2017	Prospective cohort	Russia	93 PwP without dementia and with disease onset before age 45 143 PwP without dementia and with disease onset after age 45	Unspecified	-No difference in SI severity or past SAs between groups	2	Abstract. Unclear length of follow-up. Includes previous SA/thoughts under psychotic symptoms. Unclear how SI or past SA were measured.
	Rai	2015	Cross-sectional	India	126 PwP without dementia.	N/A	-“Suicidal risk” significantly associated with higher H&Y stage, higher UPDRS motor score and total score.	3	“Suicidal risk” was determined by the Mini-International Neuropsychiatric Interview and classified as mild, moderate or severe based on intentionality and behaviors.
	Rezvani	2017	Cross-sectional	Unspecified-United States	1783 PwP	N/A	-SI associated with higher motor UPDRS scores, greater disability.	2	Abstract.
Risk of Suicide in PD Compared to Other Populations	Merschdorf	2003	Cross-sectional	Germany	49 depressed PwP 38 patients with depression without PD	N/A	-Fewer depressed PwP had a prior SA (4%) compared to depressed patients without PD (42%).	2	
	Robins	1976	Cross-sectional	Unspecified-South	45 PwP	N/A	-PwP scored higher on suicide items on Hamilton Depression	2	

				Africa	45 chronically disabled matched controls		Rating Scale compared to chronically disabled controls.		
	Behari	2011	Cross-sectional	Unspecified-India	41 patients with MSA 22 patients with PSP 126 PwP	N/A	-“Suicidal risk” found in: -30.9% with MSA -31.0% with PD -13.9% with PSP	2	Abstract. Did not define “suicidal risk”. Unclear whether differences were significant.
	Juurlink	2004	Case-control	Canada	1329 suicide victims age 66 or older 5315 matched controls	9 years	-No association between PD and suicide.	3	PwP identified by prescription record. Patients prescribed levodopa, bromocriptine, selegiline, ropinirole or pramipexole 6 months prior to death were presumed to have a diagnosis of PD.
	Kasten	2012	Cross-sectional	Unspecified- Germany	Patients with monogenic PD (23 manifesting carriers and 19 nonmanifesting carriers) Patients with idiopathic PD (38 early-onset and 90 late-onset) Healthy controls and patients with treated major depression alone.	N/A	-No difference in SI between groups. -In the idiopathic PD group, SI more frequent in early-onset (18%) than late-onset PD (10%).	3	Unclear whether differences were significant.
	Kanda	2008	Cross-sectional	Japan	58 outpatients with PD 26 outpatients with spinocerebellar degeneration	N/A	-No significant difference in rates of SI.	2	
	Starkstein	1990	Cross-sectional	United States	33 depressed PwP 33 PwP without depression, matched for age, education, disease stage and PD duration Unspecified number of non-depressed patients admitted with acute myocardial infarction.	N/A	-Significantly higher rate of SI is depressed PwP as compared to either group without depression.	2	
	Zhou	2004	Cross-sectional	China	113 depressed PwP Unspecified number of controls with depression.	N/A	-No difference in suicidality between groups.	2	Abstract. Used Chinese Classification and Diagnostic Criteria of Mental Disorders along with two scales to diagnose depression.
Effect of PD Treatments on Suicidality- Dopamine and Dopamine Agonists	Akbostanci	2017	Case-control	Unspecified-Turkey	100 PwP 100 matched controls	Unspecified	-Suicidality weakly associated with levodopa equivalent daily dose (LEDD).	2	Abstract. Controls had a significantly higher MMSE score. Excluded patients with MMSE score < 24. Unclear where healthy controls were obtained and whether they were screened for depression or other mental illness. Controls matched for age, sex, years of education and marital status.
	Berg	2011	Case report	Norway	58-year-old man with early-onset PD treated with LCIG.	2 years	-Developed SI -Successfully treated with 12 sessions right unilateral electroconvulsive therapy.	1	
	Cherington	1970	Prospective cohort	Unspecified-United States	12 PwP starting dopamine replacement therapy	Unspecified (at least 8 months)	-One developed SI. -Two SAs.	1	Incidental finding
	Fernandez	2015	Multicenter, open-label study	International	354 PwP and advanced disease with motor fluctuations despite medical management.	54 weeks	-Two completed suicides.	2	Adverse event
	Flisar	2013	Case report	Unspecified- Slovenia	65-year-old man with PD on ropinirole, levodopa, entacapone, rasagaline and apo SC injections. Recently had dopaminergic medications stopped and was started on LCIG.	Two weeks	-Committed suicide via hanging.	0	Abstract
	Hassan	2011	Case report	Unspecified-United States	43-year-old man with PD, depression, anxiety, on carbidopa/levodopa, started pramipexole.	Two years	-Developed SI two months after starting pramipexole. -Required 9 psychiatric hospitalizations for mood symptoms over the course of two year. -Fatal suicide in the setting of mania. -Mania thought to be secondary to surreptitious use of carbidopa/levodopa.	0	Abstract
	Lee	2016	Prospective cohort	South Korea	4362 neurology clinic	16 years	-Suicide associated with higher L-dopa dosage.	3	

			followed by case-control analysis		outpatients with PD		-Association remained after backward elimination to control for all other clinical variables.		
	Lew	2015	Multicenter, open-label study followed by double-blind placebo-controlled trial	International	354 PwP with motor fluctuations despite medical management.	66 weeks	-Two patients in the treatment group (started on LCIG) completed suicide during the open-label portion of the study. -Both patients had a history of depression.	3	
	Lewis	1971	Prospective cohort	Unspecified-United States	95 persons with parkinsonism treated with L-dopa.	17 months	-5 deaths, 2 due to suicide.	2	Excluded patients who had been on L-dopa less than two months. One of the patients who committed suicide had post-encephalitic parkinsonism and depression.
	Li	2018	Case-control	Singapore	10 suicide victims with PD 30 PwP who died from other causes.	10 years	-No significant difference in LEDD for PwP who died by suicide compared to those who died from other causes. -Tend toward higher LEDD in suiciders.	1	Medication records obtained anytime within two years prior to death.
	Raft	1972	Case report	Unspecified-United States	52-year-old woman with PD diagnosed three years prior. Developed depression, anxiety and SI after PD diagnosis. She was hospitalized and started on L-dopa (titrated to 300 mg/day) with significant improvement in mood and motor symptoms.	N/A	-Died by suicide via drowning after hospital discharge.	1	
	Santos-Garcia	2009	Case series	Spain	9 PwP treated with LCIG	97 months	-One suicide three months after initiation of LCIG.	0	Abstract
	Zorko	2015	Retrospective cohort	Slovenia	53 PwP treated with LCIG	8 years	-Two suicides, one via hanging three weeks after initiation of LCIG. The other via gunshot wound 5 years after initiation of LCIG.	1	Letter to the Editor
Other Medications	Lees	2015	Open-label extension of a double-blind randomized, placebo-controlled study	Unspecified-International	286 PwP treated with opicapone and levodopa	1 year	-No significant change in Columbia-Suicidality Severity Rating Scale (C-SSRS) scores.	2	Abstract. Secondary outcome. Unclear baseline.
	Santos	2016	Open-label extension of a double-blind randomized, placebo-controlled study	Unspecified-Portugal	495 PwP treated with opicapone and levodopa	1 year	-No significant change in C-SSRS scores.	2	Abstract. Secondary outcome.
	Chung	2016	Double-blind, randomized, placebo-controlled study	South Korea	380 PwP randomized to rotigotine or placebo	15 weeks	-No significant difference in incidence of SI (reported as an adverse event in 11.2% of placebo group and 11.4% of rotigotine group)	4	Patients with any history of SA or SI in the past 6 months were excluded. Secondary outcome.
	Ferreira	2016	Double-blind, randomized, placebo-controlled study	International	600 PwP on levodopa with end-of-dose motor fluctuations randomly assigned to placebo, entacapone or opicapone.	15 weeks	-No significant difference in suicidality between groups as measured by C-SSRS scores	4	Secondary outcome.
	Hauser	2009	Multicenter, double-blind, randomized, placebo-controlled trial	International	62 PwP with advanced disease and motor fluctuations on levodopa randomized to pramipexole or placebo.	7 weeks	-One suicide in the placebo group.	3	Incidental finding. No further information available about the suicide.
	Hauser	2014	Double-blind, randomized, placebo-controlled study	International	420 PwP and motor fluctuations on levodopa randomized to varying doses of tozadenant.	14 weeks	-No significant change in C-SSRS scores.	4	Excluded patients with SI or ICDs. Secondary outcome.
	Hauser	2016	Multicenter, double-blind, randomized, placebo-controlled study	International	122 PwP and apathy randomized to placebo, low or high-dose rotigotine transdermal patch.	29 weeks	-Rate of SI lower in rotigotine groups compared to placebo (6.1% versus 10.0%) as measured by C-SSRS scores.	4	Patients with a history of severe depression or SA or with SI within the past 6 months were excluded. Study terminated early after an interim futility analysis. Secondary outcome.
	Kim	2015	Open-label	International	90 PwP and advanced disease uncontrolled on levodopa and dopamine	8 weeks	-No significant change in C-SSRS scores.	3	Secondary outcome.



					agonist. Study participants also had sleep disturbance or early-morning motor impairment.				
	Li	2018	Case-control	Singapore	10 suicide victims with PD 30 PwP who died from other causes.	10 years	- Significantly higher entacapone use in PwP who died by suicide compared to those who died from other causes.	1	Medication records obtained anytime within two years prior to death. Multivariate analysis conducted but not reported.
	Zhang	2016	Double-blind, randomized, placebo-controlled	China	247 PwP and advanced disease uncontrolled on levodopa randomized to rotigotine transdermal patch or placebo.	12 weeks	-2 PwP in the rotigotine group and 3 in the placebo group had positive responses on C-SSRS.	4	Secondary outcome. No further information given on the individuals who screened positive on C-SSRS.
DBS and Other Procedural Interventions	Akbostanci	2017	Case-control	Unspecified-Turkey	100 PwP 100 matched controls	Unspecified	-No effect of DBS on suicidality	2	Abstract. Controls had a significantly higher MMSE score. Excluded patients with MMSE score < 24. Unclear where healthy controls were obtained and whether they were screened for depression or other mental illness. Controls matched for age, sex, years of education and marital status.
	Albanese	2005	Prospective cohort	Italy	72 PwP after STN-DBS	Average 34.2 months, standard deviation (SD) 18.2 months.	-No suicides -No SAs	1	Letter to the editor.
	Alugolu	2017	Prospective cohort	Unspecified-India	27 PwP after bilateral STN-DBS	6 weeks	-SI in 2 patients preoperatively.	1	Abstract. No further information on suicidal patients, no information on whether any patients developed SI post-operatively.
	Balash	2007	Case report	Israel	51-year-old man with early-onset-PD and a 48-year-old woman with early-onset-PD who underwent bilateral STN-DBS	N/A	-First patient developed SI within four months post-implantation, two months post-increase in stimulation to the left STN. -Second patient developed SI within two months of implantation and immediately after decrease in stimulation to the left STN, discontinuation of ropinirole.	1	
	Bang Henriksen	2016	Prospective cohort	Denmark	79 PwP after STN-DBS	10 years	-No suicides.	2	
	Bernal-Pacheco	2013	Retrospective cohort	United States	113 PwP undergoing STN or GPi, unilateral or bilateral DBS	24 months	-No association between suicidality and gender, disease duration, DBS target, (STN or GPi), side of DBS implantation and time of implantation. -Suicidality associated with depression. -Suicidality most frequent within 6 months of first lead placement.	1	Patients were screened for "suicidal flashes" otherwise undefined. Screening question used was not specified and was not correlated with item assessing suicidality on BDI.
	Berney	2002	Prospective cohort	Switzerland	24 PwP treated with STN-DBS	6 months	-Suicidality developed in 3 participants.	2	
	Boel	2016	Prospective cohort	Netherlands	128 PwP and severe motor fluctuations, dyskinesias, dystonia or bradykinesia. 65 randomized to GPi-DBS 63 randomized to STN-DBS	3 years	-No difference in rates of SI between groups. -One individual in GPi group developed SI.	3	
	Bridgeman	2017	Case report	United States	49-year-old man with PD with DBS in place.	N/A	-SA via overdose on citalopram.	0	Abstract. No other information given on PD diagnosis or DBS
	Buhmann	2017	Retrospective cohort	Germany	82 PwP	Average 4.7 years, SD 1.5 years	-Individual with early-onset PD s/p GPi-DBS died by suicide.	2	
	Burkhard	2004	Prospective cohort	Unspecified-Switzerland	140 persons with a variety of movement disorders treated with DBS	9 years	-2 suicides by defenestration. -1 suicide by drug overdose.	2	Unclear how many of the total cohort had a diagnosis of PD. Authors classified assisted-death/euthanasia as suicide.
	Castelli	2006	Prospective cohort	Unspecified-Italy	72 PwP after STN-DBS	Average 15 months	-No significant change in SI.	2	
	Charles	2014	Randomized, prospective, parallel group	United States	30 PwP with early stage disease, no motor fluctuations 15 randomized to medication management 15 randomized to DBS	24 months	-No SAs. -No suicides.	3	Secondary outcome. Pilot study.

Chopra	2014	Prospective cohort	United States	54 PwP after STN-DBS	6 months	-No SAs. -No suicides.	2	Excluded patients with past diagnosis of severe depression or psychosis.
Cozac	2016	Retrospective cohort	Switzerland	26 elderly PwP (age 63.2 +/- 3.3 years) after STN-DBS 124 PwP in EARLYSTIM study (age 52.9 +/- 6.6 years)	2 years	-No SI or suicides in elderly group. -No significant difference between groups.	3	
Dafsari	2018	Prospective cohort, open-label	International	44 PwP age 59 or younger, 50 PwP age 60-69 and 26 PwP age >= 70 years after STN-DBS.	6 months	-1 SA in the youngest cohort.	3	
Diestro	2017	Mixed methods, longitudinal	Philippines	17 PwP undergoing DBS	3 years	-1 SA.	1	Abstract. No other information available on SA.
Doshi	2002	Case report	India	42-year-old man with early-onset PD, no history of depression after bilateral STN-DBS	6 months	-SA six months post-operatively. -Successfully treated with fluoxetine.	1	
Esselink	2009	Randomized, controlled, observer-blind trial	Netherlands	20 PwP and advanced disease assigned to STN-DBS 13 PwP and advanced disease assigned to pallidotomy	4 years	-1 suicide in pallidotomy group three weeks post-operatively.	3	Secondary outcome.
Funkiewiez	2004	Prospective cohort	France	77 PwP after bilateral STN-DBS	3 years	-1 suicide. -4 SAs -Most SA occurred within six months post-operatively.	2	
Guehl	2006	Prospective cohort	Unspecified- France	44 PwP (31 male, 13 female) after bilateral high frequency STN-DBS	12 months	-No SI.	2	
Harries	2009	Retrospective cohort	Unspecified- England	65 PwP and other parkinsonian syndromes (51 male, 14 female) after STN-DBS	9 years	-2 SAs -No predictors of SAs on preoperative assessment.	1	Abstract.
Jean	2011	Prospective cohort	Unspecified-France	201 PwP after implantation of bilateral STN-DBS under general anesthesia	60 months	-1 SA.	2	Abstract. No further details given on this SA.
Krack	2003	Prospective cohort	France	49 PwP and advanced disease after STN-DBS	5 years	-1 suicide six months post-operatively. -3 SAs. -Individual who died by suicide had a history of severe depression, SI preoperatively.	2	No further information on SAs.
Lhommèe	2012	Prospective cohort	France	63 PwP after STN-DBS	1 year	-1 SA after a device-related infection. -1 SA two-months post-operatively.	2	
Lhommèe	2018	Parallel, open-label	International	251 PwP 127 in medical management group 124 in STN-DBS plus medical management group	2 years	-2 suicides in STN-DBS group. -1 suicide in medical therapy group.	3	
Lilleeng	2008	Case report	Norway	52-year-old man with early-onset PD and history of depression after STN-DBS	6 months	-SA by overdose on clonazepam two months after increased stimulation and decrease in L-dopa. -Improvement with decrease in stimulation, increase in L-dopa and addition of sertraline.	1	
Mahalingappa	2009	Case series	Unspecified- England	Three PwP who developed depressive symptoms after STN-DBS	Unspecified	-2 developed SI with plan.	0	Abstract
Mahgoub	2009	Case report	Unspecified- United States	66-year-old man with early-onset PD after STN-DBS, history of depression four years prior to presentation.	8 years	-Acute onset of depression with 24 hours of decrease in DBS frequency. -Resulted in SA by overdose on sleeping pills. -Suicidality resolved with increased DBS frequency.	1	
Odekerken	2014	Randomized, double-blind, controlled trial	Netherlands	128 PwP assigned to GPi or STN-DBS	1 year	-No difference in SI between groups.	4	Abstract. Secondary outcome.
Palmadottir	2014	Case report	Unspecified- United States	61-year-old man with early-onset PD with motor fluctuations and dyskinesia on medical management. History of impulse control	N/A	-Within 24 hours of starting stimulation developed SI with plan and intent. -Symptoms resolved when stimulation to the right contact was stopped, returning only if stimulation of the right contact was re-initiated.	0	Abstract

				disorder on high-dose dopamine agonist. Started on bilateral GPI-DBS with stimulation at the right contact.				
Porat	2009	Prospective cohort	Israel	22 PwP after STN-DBS	3 months	-7 individuals developed SI. -1 SA one month post-operatively. -Significant increase in SI post-operatively, despite no change in overall depressive symptoms.	2	
Regis	2015	Prospective cohort	France	14 PwP with major contraindications to DBS who underwent STN Gamma Knife Radiosurgery	Unspecified	-1 suicide 17 months post-operatively.	1	Abstract. Total length of follow-up for all patients not given. No additional details given on suicide victim. Specific contraindications to DBS are not given.
Regis	2017	Prospective cohort	France	14 PwP (10 male, 4 female) after STN Gamma Knife Radiosurgery	2 years	-1 suicide six months post-operatively.	1	Abstract. No additional details given on suicide victim.
Rodrigues	2010	Case series and case-control analysis	Unspecified- Portugal	3 PwP after STN-DBS who attempted suicide 120 PwP after STN-DBS who did not attempt suicide	1 year	-Those who attempted suicide had good motor outcomes, significant decrease in dopaminergic drugs. -SA occurred at 2 months, 13 months and 15 months postoperatively.	3	
Saiki	2016	Cross-sectional	Unspecified- Japan	37 PwP referred for DBS (20 male, 17 female)	N/A	-Out of 17 PwP excluded, 3 were excluded because of SI.	1	Abstract. Unclear design and outcomes.
Sauvagat	2011	Descriptive	France	70 PwP who filled out preoperative psychiatric screening form prior to DBS in attempt to decrease suicide risk after DBS.	N/A	-No suicides.	1	Abstract. Sample size likely too small to determine if survey was effective. There was no control group. Limited information given on what was included in the screening form and how this might differ from standard pre-operative screening.
Schüpbach	2007	Prospective cohort	France	171 PwP after STN-DBS	9 years	-1 suicide by hanging in a 57-year-old woman with a history of depression.	3	All patients had severe levodopa-related motor complications. Patients excluded if over 75, active severe psychiatric illness or dementia.
Seijo Zazo	2017	Prospective cohort	Unspecified-Spain	30 PwP after STN-DBS	1 year	-No change in SI over study period (as measured by Beck Scale for SI).	2	
Soulas	2008	Case-control	France	200 PwP (127 male, 73 female) after bilateral STN-DBS	9 years	-Compared characteristics of suicidal and non-suicidal PwP. -2 suicides (1%). -4 SAs (2%). -No difference in age, disease duration, Montgomery-Asberg Depression Rating Scale score between groups.	3	
Strutt	2012	Prospective cohort	United States	17 PwP after STN-DBS 22 PwP managed medically	6 months	-1 suicide in STN-DBS group three months post-operatively (5%). -No suicides in control group	2	Patients with "psychiatric complications" were excluded. Treatment group had lower education levels and higher L-dopa levels at baseline. Neither of these variables were significantly correlated with outcome measures.
Tir	2007	Prospective cohort	France	100 PwP after STN-DBS	12 months	-1 SA by hanging 8 months post-operatively. -1 suicide by hanging 3 months post-operatively.	2	
Toft	2011	Retrospective cohort	Norway	144 PwP after STN-DBS	7 years	-2 suicides (1.4%). -Suicides occurred 15 and 16 months post-operatively.	3	
Umemura	2011	Retrospective cohort	Japan	180 PwP after STN-DBS	87 months	-2 SAs. -Both had significant post-operative improvement in motor function.	3	
Voon	2004	Cross-sectional	International	406 PwP after STN-DBS. Included 16 DBS centers.	N/A	-2 suicides (0.5%) 3 months and 3 years post-operatively. -7 SAs (1.7%) on average 11.4 months postoperatively. Three occurred within the first 2 months post-operatively.	2	Abstract. No further information given about SAs or completions. Response rate was 50% overall.
Voon	2008	Cross-sectional followed by nested case-control analysis.	International	5311 PwP after STN-DBS. Included 55 DBS centers.	N/A	-24 suicides (0.45%). -48 SAs (0.90%). -Overall suicide risk elevated when compared to age, gender and country-matched population for four years postoperatively. -Half of those who attempted or died by suicide had reported SI. -Significant association between SAs and postoperative depression, being single, history of compulsive medication use or ICDs, younger age, earlier-onset disease and prior SA. -Postoperative depression remained associated after Bonferroni correction.	3	

	Wark	2016	Case series	Unspecified- United States	3 PwP who developed acute depression after STN-DBS.	Unspecified	-2 developed SI. -Stimulation at right ventral contact.	1	
	Weintraub	2013	Randomized controlled trial	United States	Phase 1: 255 PwP. 121 randomized to DBS and 134 randomized to medical therapy.  Phase 2: 299 PwP. 147 randomized to STN-DBS and 152 randomized to GPi-DBS.	Phase 1: 6 months  Phase 2: 24 months	Phase 1: no suicidal behaviors, no significant difference in rates of SI between groups.  Phase 2: No significant difference in rates of SI between groups.	5	
	Williams	2017	Case report	Unspecified- United States	61-year-old man with PD with bilateral STN-DBS in place. History of treatment resistant depression and obsessive-compulsive disorder for 30 years.	Unspecified	-Developed acute SI, successfully treated with 10 sessions of right unilateral ultra-brief pulse ECT with resolution of symptoms.	1	
	York	2012	Cross-sectional	International	131 DBS centers	N/A	-90% of DBS centers rejected patients with active SI.	2	Abstract.
	York	2012	Cross-sectional	International	131 DBS centers	N/A	-Patients perceived higher rates of suicide post-operatively.	2	Abstract.
Treatment of Suicidality in PD	Berg	2011	Case report	Norway	58-year-old man with early-onset PD developed suicidality and other depressive symptoms. LCIG in place for 2 years.	Unspecified	-Successfully treated with 12 sessions right unilateral ECT.	1	
	Dashtipour	2016	Case report	Unspecified- United States	48-year-old man with PD after STN-DBS.	Unspecified	-Developed suicidality successfully treated with 13 sessions of bilateral ECT.	0	Abstract.
	Doshi	2002	Case report	India	42-year-old man with early-onset PD and no history of depression who after bilateral STN-DBS.	1 year	-SA via overdose 6 months post-operatively. -Suicidality resolved with fluoxetine.	1	
	Erickson	2015	Case report	Unspecified-United States	61-year-old man with history of PTSD, depression and early-onset PD after implantation of unilateral DBS and two revisions.	5 years	-Developed SI and had 2 SAs within 4 years post-operatively. -Successfully treated with left anterior right temporal ECT followed by bifrontal ECT.	0	Letter to the Editor.
	Gadit	2012	Case report	Unspecified- Canada	60-year-old man with PD, severe obsessive-compulsive disorder.	Unspecified	-SA via overdose on clonazepam, sodium pentobarbitol. -Successfully treated with 9 cycles of ECT, quetiapine, clonazepam, escitalopram and L-dopa.	1	
	Hagikura	2012	Case report	Japan	62-year-old woman with PD.	7.5 months	-Developed SI, trialed on milnacipran with no improvement. -Successfully treated with mirtazapine 30 mg daily, L-dopa, and pramipexole.	1	
	Linse	2016	Randomized, controlled and rater-blinded trial.	Unspecified- Germany	13 PwP randomized to "low-threshold psychoeducative group-intervention." 13 PwP randomized to wait list.	6 months	-Significant decrease in SI immediately after intervention. -Decrease did not persist at six-month follow-up.	3	Abstract. Intervention not described in detail.
	Williams	2017	Case report	Unspecified- United States	61-year-old man with PD with bilateral STN-DBS in place. History of treatment resistant depression and obsessive-compulsive disorder for 30 years.	Unspecified	-Developed acute SI, successfully treated with 10 sessions of right unilateral ultra-brief pulse ECT with resolution of symptoms.	1	

### Appendix 3. References for Articles Meeting Inclusion Criteria

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