Neurodevelopmental, **Psychiatric Disorders**, and **Parkinson's Disease**

1. Introduction

Neurodevelopmental and psychiatric disorders are related to Parkinson's disease (PD) in three main ways: some neurodevelopmental conditions are associated with higher later-life PD risk, psychiatric symptoms are core and often prodromal features of PD, and these disorders partly converge through shared genetic, synaptic, inflammatory, and circuit-level biology. Large population studies now show that neurodevelopmental conditions are more common in people with PD and that autism spectrum disorder (ASD) is associated with substantially increased future PD risk (Rast et al., 2025; Yin et al., 2025). Psychiatric illness also intersects with PD before and after diagnosis: depression, anxiety, psychosis, apathy, and related symptoms are common across the PD course, can precede motor onset, and predict worse disability, cognitive impairment, and progression once PD is present (Weintraub et al., 2022; Burchill et al., 2024; Yoon et al., 2024).

At the mechanistic level, the literature increasingly argues against a strict developmental-versus-degenerative divide. Reviews and genomic studies describe overlap at synapses, dopaminergic and monoaminergic systems, mitochondrial biology, neuroinflammation, gut-brain signaling, and pleiotropic loci such as SNCA and PARK2 (Torres et al., 2020; Sadeghi et al., 2021; Farrow et al., 2021). Still, the strongest evidence is uneven: epidemiologic support is now moderate to strong for some associations such as ASD and broad mental illness, whereas causal pathways remain mixed and Mendelian randomization studies often disagree with observational cohorts (Sian-Hulsmann et al., 2026; Xiang et al., 2025; Yoon et al., 2024).

Are neurodevelopmental and psychiatric disorders associated with Parkinson's disease?

Requires at least 5 papers that directly answer your question. Try adjusting your query to find more papers.

FIGURE 1 Consensus on links between these disorders and Parkinson's disease

2. Methods

The search ran across more than 170 million research papers in Consensus, drawing from Semantic Scholar, PubMed, and other scholarly sources. The workflow identified 117 unique relevant papers after screening 230 candidates from direct searches and citation expansion, and 50 papers were included for this synthesis. Priority was given to large epidemiologic cohorts, systematic reviews, meta-analyses, Mendelian randomization studies, and high-impact mechanistic reviews spanning neurodevelopmental, psychiatric, and Parkinson's literatures.

Search Strategy

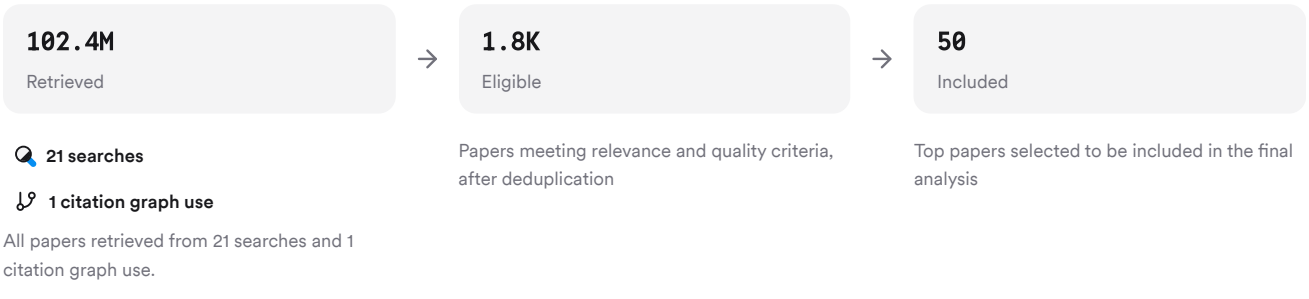

FIGURE 2 Deep search screening and inclusion flow

Six targeted searches covered risk, comorbidity, shared mechanisms, genetics, neurodevelopmental frameworks, and bidirectional psychiatric-PD relationships.

3. Results

3.1 Key Papers

The corpus is anchored by one large US case-control study of neurodevelopmental conditions in PD, one Swedish nationwide cohort on ASD and future PD risk, and one meta-analysis quantifying how psychiatric comorbidity shapes PD outcomes (Rast et al., 2025; Yin et al., 2025; Burchill et al., 2024). Together, these papers establish the epidemiologic association, quantify risk in a specific neurodevelopmental population, and show why the psychiatric dimension matters clinically after PD onset (Rast et al., 2025; Yin et al., 2025; Burchill et al., 2024).

Paper	Summary
(Rast et al., 2025)	NDCs are more common in PD cases (Rast et al., 2025)
(Stuparu et al., 2023)	**ASD** linked to roughly **4.4-fold PD risk** (Yin et al., 2025)
(Xiang et al., 2025)	Psychiatric comorbidity marks **poorer PD prognosis** (Burchill et al., 2024)

FIGURE 3 Anchor papers for epidemiology and prognosis

3.2 Neurodevelopmental Links

The strongest direct neurodevelopmental evidence is epidemiologic. In All of Us data, PD cases had about twice the adjusted odds of a recorded neurodevelopmental condition compared with controls (Rast et al., 2025). In the Swedish cohort, ASD was associated with higher PD incidence, with risk only partly attenuated by antipsychotic exposure and persisting after adjustment for depression and antidepressant use (Yin et al., 2025).

A broader systematic review found parkinsonism reported across 69 genetic neurodevelopmental disorders, often with early motor onset, dopaminergic imaging changes, and neuropathology supporting genuine neurodegeneration rather than mere phenocopy (Von Scheibler et al., 2022). Medicare data in older adults with neurodevelopmental disorders further suggest that PD and other neurodegenerative diseases are up to three times more common in these populations (Rodriguez & Willis, 2025).

3.3 Psychiatric Associations

Dimension	Before PD	During PD	Outcome Relevance	Citations
Depression	Often **prodromal**	Common across stages	Worse cognition, disability, progression	(Weintraub et al., 2022; Burchill et al., 2024)
Psychosis	Can emerge early	Spectrum through disease course	Linked to poorer prognosis	(Pagonabarraga et al., 2024; Burchill et al., 2024)
Anxiety	Elevated before diagnosis	Common non-motor symptom	Reduces quality of life	(Weintraub et al., 2022; Yoon et al., 2024)
Bipolar/Schizophrenia	Associated with later PD risk	Some shared circuitry proposed	Evidence more mixed mechanistically	(Yoon et al., 2024; Karunakaran et al., 2024)

FIGURE 4 Psychiatric relationships across the Parkinson's disease course

Psychiatric disorders are not peripheral to PD; the literature repeatedly describes PD as a neuropsychiatric disorder rather than a purely motor syndrome (Weintraub & Burn, 2011; Weintraub & Stern, 2005; Stuparu et al., 2023). Depression, anxiety, psychosis, apathy, sleep-wake disorders, and impulse-control syndromes can predate diagnosis or emerge during progression, and many become more frequent over time (Weintraub & Mamikonyan, 2019; Hussein et al., 2021; Szarpak et al., 2022).

The prognostic evidence is strongest for depression, psychosis, and apathy. Meta-analysis shows each is associated with at least one adverse PD outcome, including cognitive impairment, disability, or faster disease progression (Burchill et al., 2024). Large cohort work also suggests broad mental illness is associated with later PD, with stronger associations for early-onset than late-onset PD and particularly high risks reported after schizophrenia and bipolar disorder (Yoon et al., 2024).

3.4 Shared Biology

Shared biology centers on convergent vulnerability in synapses, dopamine-related circuits, developmentally regulated genes, and inflammatory-metabolic pathways. Reviews of ASD-PD overlap emphasize SNCA, PARK2, FMR1, 22q11 loci, synaptic dysfunction, neurogenesis, and dopamine-neuron biology (Torres et al., 2020). Transcriptomic work found one of the strongest cross-disorder correlations between ASD and PD, while local genetic-correlation analyses identified PD overlap with schizophrenia despite minimal global correlation (Sadeghi et al., 2021; Reynolds et al., 2022).

Other studies support a developmental contribution to PD biology itself. PD risk loci show fetal-cortex regulatory connections consistent with neurodevelopmental involvement (Farrow et al., 2021). Interactome analysis of PD and schizophrenia identified a prenatally expressed shared cluster enriched for stem-cell pluripotency and 22q11 deletion overlap, suggesting a neurodevelopmental route to comorbidity in at least some subtypes (Karunakaran et al., 2024). Across broader neuropsychiatric and neurodegenerative comparisons, common signals repeatedly involve neuroinflammation, mitochondrial processes, vesicular transport, microbiota-gut-brain pathways, and monoamine dysfunction (Gupta et al., 2023; Denman et al., 2023; Wu et al., 2023).

Results Timeline

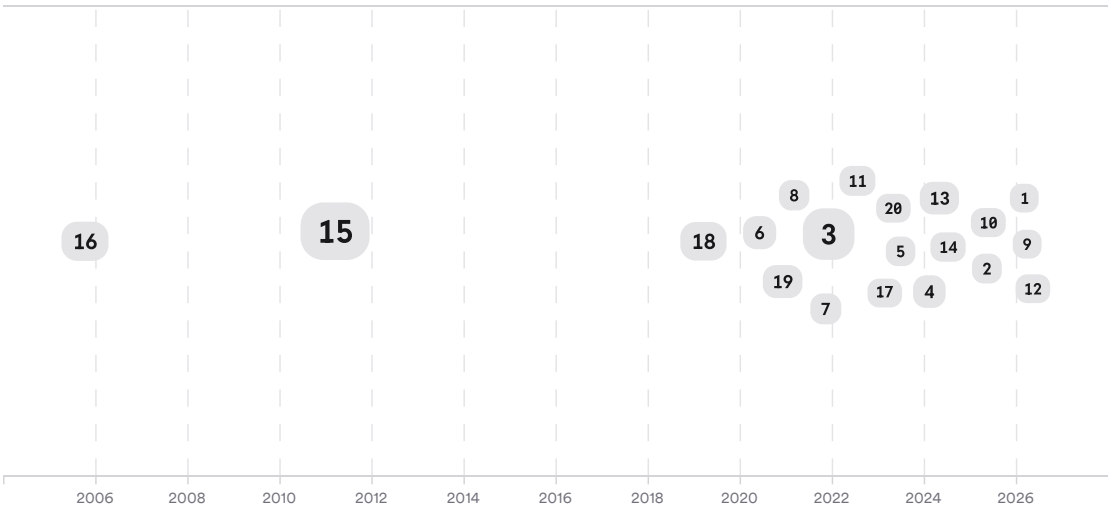

FIGURE 5 Timeline of influential papers; larger markers indicate more citations

The timeline suggests a shift from describing psychiatric complications of established PD toward studying prodromal symptoms, shared genetics, and lifespan neurodevelopmental continuity. The most recent papers are increasingly population-based and mechanistic, but they still leave causality unresolved (Weintraub & Burn, 2011; Yin et al., 2025; Sian-Hulsmann et al., 2026).

Top Contributors

Type	Name	Papers
Author	D. Weintraub	[c534cdfbdb5751bb921028f7d09da0a4][004beeb4c7685181bf21efa7186ad113] [df3343f667615bd38ce3dfca28170177][04848d14e4eb5fd08ff6dd30e27d022c] [e0dd94e8df095443bb935994bda26d9e][a8b301e2b3d15654aa648de721b901b0]
Author	D. Aarsland	[c534cdfbdb5751bb921028f7d09da0a4][df3343f667615bd38ce3dfca28170177] [40e5ae0fc190559e93f4103b69327283]
Author	M. Onofrj	[9af73cde84c65f82a15b112bbe60c991][264eed7e6a8e568db0b475f9a0c9dc20]
Journal	*Journal of Neural Transmission*	[e7c87044ebfb5f71971f060eaf6e36b9][2f8a241f1065524eb93d12907c4979d8] [860e303b424f5b5a87b876f9fd82a7d9]
Journal	*NPJ Parkinson`s Disease*	[7c0e9f2aa6ab544f96a95ba17dc2b5b8][2e36c7ce4a4f5ad4a915ea351353e080] [2e36c7ce4a4f5ad4a915ea351353e080]
Journal	*The Lancet. Neurology*	[c534cdfbdb5751bb921028f7d09da0a4][40e5ae0fc190559e93f4103b69327283]

FIGURE 6 Authors and journals appearing most often here

4. Discussion

The most solid conclusion is that PD and psychiatric disorders are tightly linked clinically. Across reviews, cohorts, and meta-analysis, psychiatric symptoms are common in PD, often precede motor diagnosis, and carry real prognostic weight rather than being incidental reactions to disability (Weintraub et al., 2022; Burchill et al., 2024; Stuparu et al., 2023). That part of the literature is mature and replicated.

The neurodevelopmental link is newer and more heterogeneous. Large contemporary datasets support association between neurodevelopmental conditions and PD, especially ASD (Rast et al., 2025; Yin et al., 2025; Rodriguez & Willis, 2025). Mechanistic papers make the link biologically plausible through shared synaptic and developmental pathways, but much of this evidence is inferential, preclinical, or based on genetic overlap rather than direct causal demonstration (Tanaka et al., 2022; Taoufik et al., 2018; Farrow et al., 2021).

Causality remains the main unresolved issue. Observational studies often show that depression, bipolar disorder, schizophrenia, anxiety, or ASD are associated with later PD (Attaallah et al., 2025; Yoon et al., 2024). But Mendelian randomization studies are inconsistent: one found no significant causal effect for ADHD, bipolar disorder, depression, schizophrenia, or OCD on PD, while another suggested reverse effects from PD to bipolar disorder and yet another found conflicting MR versus cohort results for major depression (Ge et al., 2025; Wu et al., 2023; Xiang et al., 2025).

Claim	Evidence Strength	Reasoning	Papers
Psychiatric symptoms are **core features of PD** and often shape disability and quality of life.	Strong	Repeated across high-citation reviews and clinical syntheses.	(Weintraub & Burn, 2011; Weintraub et al., 2022; Han et al., 2018)
Depression, psychosis, and apathy in PD mark poorer prognosis.	Strong	Supported by a large meta-analysis of 55 studies.	(Burchill et al., 2024)

Claim	Evidence Strength	Reasoning	Papers
Some **neurodevelopmental disorders**, especially ASD, are associated with higher later PD risk.	Moderate	Large modern cohorts support association, but lifetime follow-up is still limited.	(Yin et al., 2025; Rast et al., 2025; Rodriguez & Willis, 2025)
PD, neurodevelopmental, and psychiatric disorders share **genetic and molecular pathways**.	Moderate	Convergent evidence from reviews, transcriptomics, and local genetic analyses.	(Torres et al., 2020; Sadeghi et al., 2021; Reynolds et al., 2022)
Psychiatric or neurodevelopmental disorders **causally cause PD** in general.	Weak	MR results are inconsistent and confounding remains substantial.	(Sian-Hulsmann et al., 2026; Ge et al., 2025; Xiang et al., 2025)

FIGURE 7 Key claims and supporting evidence in this corpus

5. Conclusion

The relationship between neurodevelopmental and psychiatric disorders and Parkinson's disease is real, but it is not a single relationship. Neurodevelopmental conditions appear associated with higher PD risk in some populations, psychiatric syndromes are intrinsic and often prodromal parts of PD, and all three disorder classes show partial convergence in genes, circuits, and cellular stress pathways (Sian-Hulsmann et al., 2026; Attaallah et al., 2025; Smeland et al., 2025). The clearest evidence is clinical and epidemiologic; the weakest point is causal attribution.

Research Gaps

The main gaps are long-term causal inference, subtype specificity, and integration across developmental, psychiatric, and prodromal PD frameworks (Sian-Hulsmann et al., 2026; Behrens et al., 2026). Evidence is richest for mood and psychosis in PD, but thinner for which early-life disorders, genes, and exposures define true PD vulnerability.

Topic/Outcome	Longitudinal Cohorts	Genetic Causality	Mechanistic Validation	Diverse Older Populations
ASD to PD risk	4	2	3	2
ADHD/NDC to PD risk	2	1	2	2
Depression/anxiety prodrome	10	4	6	5
Bipolar/schizophrenia links	5	4	3	3
Shared multi-omics pathways	3	4	1	2

Open Research Questions

Three questions stand out for moving the field from association to mechanism and prevention.

Question	Why
Do specific neurodevelopmental disorders independently increase Parkinson's disease risk after full adjustment for medication exposure, depression, and healthcare-contact bias?	This would clarify whether observed associations reflect shared biology or diagnostic and treatment confounding.
Which shared genes and circuits distinguish true developmental vulnerability to Parkinson's disease from psychiatric symptoms that are merely prodromal PD manifestations?	This would separate etiologic overlap from early disease presentation and improve biological classification.
Can multi-omics and longitudinal imaging identify a high-risk subtype linking ASD, mood disorders, or psychosis to early-onset Parkinson's disease?	This could enable earlier detection in the subgroup where psychiatric associations appear strongest.

PD is therefore best viewed not as an isolated movement disorder, but as part of a broader lifespan brain-disorder continuum that overlaps meaningfully, though incompletely, with neurodevelopmental and psychiatric disease.

References

Attaallah, B., Waters, S., Marshall, C., & Noyce, A. (2025). The relationship between neuropsychiatric dimensions and markers of Parkinson's disease risk in the UK Biobank. *NPJ Parkinson's Disease, 11*. https://doi.org/10.1038/s41531-025-01181-y

Behrens, L. M. P., Fernandes, G. G. D., Gonçalves, G. F., Nunes, F., Weimer, R. D., Moreira, J. C. F., & Dorn, M. (2026). Limitations and opportunities in multi-omics integration for neurodevelopmental, neurodegenerative and psychiatric disorders: A systematic review.. *Neuroscience*. https://doi.org/10.1016/j.neuroscience.2026.01.019

Burchill, E., Watson, C., Fanshawe, J., Badenoch, J. B., Rengasamy, E., Ghanem, D. A., Holle, C., Conti, I., Sadeq, M. A., Saini, A., Lahmar, A., Cross, B., McGuigan, G., Nandrha, A., Kane, E. J., Wozniak, J., Ghorab, R. M. F., Song, J., Sommerlad, A., . . . Rogers, J. P. (2024). The impact of psychiatric comorbidity on Parkinson's disease outcomes: a systematic review and meta-analysis. *The Lancet Regional Health - Europe, 39*. https://doi.org/10.1016/j.lanepe.2024.100870

Denman, C. R., Park, S. M., & Jo, J. (2023). Gut-brain axis: gut dysbiosis and psychiatric disorders in Alzheimer's and Parkinson's disease. *Frontiers in Neuroscience, 17*. https://doi.org/10.3389/fnins.2023.1268419

Farrow, S. L., Schierding, W., Gokuladhas, S., Golovina, E., Fadason, T., Cooper, A., & O'Sullivan, J. (2021). Establishing gene regulatory networks from Parkinson's disease risk loci. *Brain, 145*, 2422 - 2435. https://doi.org/10.1093/brain/awac022

Ge, L., Guo, Y., Xu, X., Xu, J., & Zhou, T. (2025). Causal Relationships Between Mental Health Disorders and Parkinson's Disease: A Mendelian Randomization Study.. *Psychiatry and clinical psychopharmacology*. https://doi.org/10.5152/pcp.2025.251121

Gupta, R., Advani, D., Yadav, D., Ambasta, R. K., & Kumar, P. (2023). Dissecting the Relationship Between Neuropsychiatric and Neurodegenerative Disorders. *Molecular Neurobiology, 60*, 6476 - 6529. https://doi.org/10.1007/s12035-023-03502-9

Han, J. W., Ahn, Y. D., Kim, W., Shin, C., Jeong, S., Song, Y. S., Bae, Y. J., & Kim, J.-M. (2018). Psychiatric Manifestation in Patients with Parkinson's Disease. *Journal of Korean Medical Science, 33*. https://doi.org/10.3346/jkms.2018.33.e300

Hussein, A., Guevara, C., Del Valle, P., Gupta, S., Benson, D., & Huntley, G. W. (2021). Non-Motor Symptoms of Parkinson's Disease: The Neurobiology of Early Psychiatric and Cognitive Dysfunction. *The Neuroscientist : a review journal bringing neurobiology, neurology and psychiatry, 29*, 97 - 116. https://doi.org/10.1177/10738584211011979

Karunakaran, K. B., Jain, S., Brahmachari, S. K., Balakrishnan, N., & Ganapathiraju, M. (2024). Parkinson's disease and schizophrenia interactomes contain temporally distinct gene clusters underlying comorbid mechanisms and unique disease processes. *Schizophrenia, 10*. https://doi.org/10.1038/s41537-024-00439-3

Pagonabarraga, J., Bejr-Kasem, H., Martínez-Horta, S., & Kulisevsky, J. (2024). Parkinson disease psychosis: from phenomenology to neurobiological mechanisms. *Nature Reviews Neurology, 20*, 135 - 150. https://doi.org/10.1038/s41582-023-00918-8

Rast, J. E., Rosso, A. L., James, B., Underwood, J. F., Bergstedt, J., Ahlqvist, V., Grove, J., Fang, F., Goldstein, N., Vivanti, G., Levine, S. Z., Nordström, A., Schendel, D., Lyall, K., Nordström, P., Ballin, M., Stafford, J., Naj, A. C., & Lee, B. K. (2025). Association of neurodevelopmental conditions with Alzheimer's disease and related dementias and Parkinson's disease. *The journals of gerontology. Series A, Biological sciences and medical sciences, 81*. https://doi.org/10.1093/gerona/glaf281

Reynolds, R., Wagen, A. Z., Lona-Durazo, F., Scholz, S. W., Shoai, M., Hardy, J., Taliun, S. G. G., & Ryten, M. (2022). Local genetic correlations exist among neurodegenerative and neuropsychiatric diseases. *NPJ Parkinson's Disease, 9*. https://doi.org/10.1038/s41531-023-00504-1

Rodriguez, B., & Willis, A. W. (2025). Comorbidity Risk Assessment in Medicare Beneficiaries with Neurodevelopmental Disorders. *Innovation in Aging, 9*. https://doi.org/10.1093/geroni/igaf122.3735

Sadeghi, I., Gispert, J., Palumbo, E., Muñoz-Aguirre, M., Wucher, V., D'Argenio, V., Santpere, G., Navarro, A., Guigó, R., & Vilor-Tejedor, N. (2021). Brain transcriptomic profiling reveals common alterations across neurodegenerative and psychiatric disorders. *Computational and Structural Biotechnology Journal, 20*, 4549 - 4561. https://doi.org/10.1016/j.csbj.2022.08.037

Sian-Hulsmann, J., Knudsen, L. V., Sheldrick-Michel, A. J., Riederer, P., & Michel, T. M. (2026). The lifespan continuum of brain disorders: investigating links between neurodevelopmental and neurodegenerative disease-chicken or egg?. *Journal of neural transmission*. https://doi.org/10.1007/s00702-025-03078-9

Smeland, O., Kutrolli, G., Bahrami, S., Fominykh, V., Parker, N., Fuhrer, J., Hindley, G., Rødevand, L., Jahołkowski, P., Tesfaye, M., Parekh, P., Elvsåshagen, T., Grotzinger, A., Steen, N. E., Van Der Meer, D., O'Connell, K., Djurovic, S., Dale, A., Shadrin, A., . . . Andreassen, O. (2025). A genome-wide analysis of the shared genetic risk architecture of complex neurological and psychiatric disorders. *Nature Neuroscience, 28*, 2439 - 2450. https://doi.org/10.1038/s41593-025-02090-2

Stuparu, A. Z., Ciorabai, E., Pantu, C., Stuparu, A., Muja, L., Vranau, D., Axelerad, S., & Axelerad, A. (2023). Unveiling the Mind: A Comprehensive Review of Psychiatric Disorders in Parkinson's Disease. *ARS Medica Tomitana, 29*, 36 - 45. https://doi.org/10.2478/arsm-2023-0007

Szarpak, J., Drożak, P., Piwonski, M., Wróblewski, H., & Morylowska-Topolska, J. (2022). Should patients with Parkinson's disease only visit a neurologist's office? - a narrative review of neuropsychiatric disorders among people with Parkinson's disease. *Current Problems of Psychiatry, 23*, 220 - 236. https://doi.org/10.2478/cpp-2022-0021

Tanaka, M., Spekker, E., Szabó, Á., Polyák, H., & Vécsei, L. (2022). Modelling the neurodevelopmental pathogenesis in neuropsychiatric disorders. Bioactive kynurenines and their analogues as neuroprotective agents—in celebration of 80th birthday of Professor Peter Riederer. *Journal of Neural Transmission, 129*, 627 - 642. https://doi.org/10.1007/s00702-022-02513-5

Taoufik, E., Kouroupi, G., Zygogianni, O., & Matsas, R. (2018). Synaptic dysfunction in neurodegenerative and neurodevelopmental diseases: an overview of induced pluripotent stem-cell-based disease models. *Open Biology, 8*. https://doi.org/10.1098/rsob.180138

Torres, C., Wassouf, Z., Wassouf, Z., Zafar, F., Sastre, D., Outeiro, T., & Schüle, B. (2020). The Role of Alpha-Synuclein and Other Parkinson's Genes in Neurodevelopmental and Neurodegenerative Disorders. *International Journal of Molecular Sciences, 21*. https://doi.org/10.3390/ijms21165724

Von Scheibler, E., Van Eeghen, A. V., De Koning, T. D., Kuijf, M., Zinkstok, J., Müller, A., Van Amelsvoort, T., & Boot, E. (2022). Parkinsonism in Genetic Neurodevelopmental Disorders: A Systematic Review. *Movement Disorders Clinical Practice, 10*, 17 - 31. https://doi.org/10.1002/mdc3.13577

Weintraub, D., Aarsland, D., Chaudhuri, K., Dobkin, R., Leentjens, A., Rodríguez-Violante, M., & Schrag, A. (2022). The neuropsychiatry of Parkinson's disease: advances and challenges. *The Lancet. Neurology, 21*, 89 - 102. https://doi.org/10.1016/s1474-4422(21)00330-6

Weintraub, D., & Burn, D. (2011). Parkinson's disease: The quintessential neuropsychiatric disorder. *Movement Disorders, 26*. https://doi.org/10.1002/mds.23664

Weintraub, D., & Stern, M. (2005). Psychiatric complications in Parkinson disease.. *The American journal of geriatric psychiatry : official journal of the American Association for Geriatric Psychiatry, 13 10*, 844-51. https://doi.org/10.1097/00019442-200510000-00003

Weintraub, D., & Mamikonyan, E. (2019). The Neuropsychiatry of Parkinson Disease: A Perfect Storm. *The American journal of geriatric psychiatry : official journal of the American Association for Geriatric Psychiatry, 27*, 998 - 1018. https://doi.org/10.1016/j.jagp.2019.03.002

Wu, Q., Liu, S., Huang, X., Liu, J., Wang, Y., Xiang, Y., Tang, X., Xu, Q., Yan, X., Tang, B., & Guo, J.-F. (2023). Bidirectional Mendelian randomization study of psychiatric disorders and Parkinson's disease. *Frontiers in Aging Neuroscience, 15*. https://doi.org/10.3389/fnagi.2023.1120615

Xiang, L., Xu, R., Zhou, X., Ren, X., Li, Z., & Wu, I. X. (2025). Associations between major depressive disorders and Parkinson's Disease and impact of their comorbidity sequence.. *Journal of affective disorders*. https://doi.org/10.1016/j.jad.2025.03.065

Yin, W., Reichenberg, A., Beeri, S. M., Levine, S. Z., Ludvigsson, J. F., Figee, M., & Sandin, S. (2025). Risk of Parkinson Disease in Individuals With Autism Spectrum Disorder.. *JAMA neurology*. https://doi.org/10.1001/jamaneurol.2025.1284

Yoon, S., Lee, S., Suh, J., Yang, S. N., Han, K.-D., & Kim, Y. W. (2024). Different risks of early-onset and late-onset Parkinson disease in individuals with mental illness. *NPJ Parkinson's Disease, 10*. https://doi.org/10.1038/s41531-023-00621-x