



Evidence Review

Possible and likelihood of side effects and predicting factors for adverse side effects of treatment of Botulinum toxin injections for the treatment of hypersalivation in patients with progressive neurological conditions.

Key messages

Across the included studies, botulinum toxin injections were generally reported as effective for reducing hypersalivation in people with progressive neurological conditions, but adverse effects ranged widely in frequency and severity. Most studies described mild and self-limiting reactions such as dry mouth, thickened saliva, transient dysphagia, local pain, haematoma, chewing weakness, or temporary changes in saliva viscosity. Several reviews and clinical series noted that adverse effects were usually uncommon, particularly when ultrasound guidance was used. However, a smaller number of reports documented more serious complications, including aspiration pneumonia, marked deterioration in bulbar function, recurrent jaw dislocation, severe oral–motor impairment requiring feeding changes, and, in rare cases, rapid loss of swallowing and speech abilities in people with bulbar-onset ALS. Risk appeared to vary by toxin type, dose, injection site, underlying diagnosis, and baseline bulbar function. Children and individuals with advanced neurological disease showed a greater susceptibility to significant oral motor difficulties. Robust comparative data remains limited by small samples, inconsistent reporting, and heterogeneous study designs.

(Below is a breakdown of the findings from this review based on the type of neurological condition).

Motor Neurone Disease (MND) / Amyotrophic Lateral Sclerosis (ALS)

Taubert et al., 2025 [1]

- Mentions botulinum toxin as an option within saliva-management pathways but does not report specific adverse effects.



James et al., Cochrane Review, 2022 [3]

- Across trials, no severe adverse events attributable to botulinum toxin.
- Adverse events occurred at similar rates in toxin and placebo groups (9 vs 10), with no increased risk of aspiration, dysphagia, or respiratory decline.

Shehee et al., 2020 [4]

- Generally well tolerated.
- Mild effects: dry mouth, local pain, chewing difficulty.
- More serious events reported in some studies: recurrent temporomandibular joint dislocation, rapid bulbar deterioration.

Squires et al., 2014 (systematic review) [12]

- Mild adverse effects with botulinum toxin A: dry mouth, thickened saliva, discomfort.
- Botulinum toxin B associated with broader effects: pain, haemorrhage, chewing weakness, respiratory infections, facial paresis, dyspnoea.
- Serious events reported (pneumonia, respiratory symptoms), though attribution to toxin was unclear.

Meijer et al., 2008 (ALS case report) [15]

- Severe and rapid bulbar deterioration after injection: complete loss of swallow and speech within days.
- Literature review noted complications such as jaw dislocation, facial weakness, and tongue swelling.

Verma & Steele, 2006 [16]

- No major adverse effects reported.
- One patient later required gastrostomy, judged more likely related to disease progression.

Parkinson's Disease and Parkinsonism

Yang et al., 2023 (systematic review & meta-analysis) [2]

- Common mild adverse events: dry mouth (most frequent), worsened gait, diarrhoea, dysphagia, neck pain, chewing weakness.
- Serious events were rare and not consistently linked to treatment.

Bernardo et al., 2019 (Rett syndrome – neurogenetic condition, included for completeness) [6]

- One instance of temporary worsening of dysphagia.
- No other adverse events.

Ruiz-Roca et al., 2019 (systematic review)

- Reports effectiveness but does not detail adverse reactions.



Bruno et al., 2016 [9]

- Minor transient local adverse effects in 11 cases; no severe reactions.

Mancini et al., 2003 (double-blind RCT) [18]

- No treatment-related adverse events observed.
- Injection procedure caused brief discomfort only.

Children with Neurodevelopmental Disorders / Cerebral Palsy

Rodwell et al., 2012 (systematic review) [14]

- Adverse effects in 2–41% of injections.
- Most common: dysphagia, thickened saliva.
- Rare but serious: aspiration pneumonia; one trial stopped early due to safety concerns.

van Hulst et al., 2017 [8]

- Oral-motor function deterioration common: problems with swallowing, eating, drinking, speech.
- Some cases required hospitalisation or tube feeding.
- Increased saliva viscosity also reported.

Sillanpää et al., 2015 [11]

- Only one transient dysphagia episode among 41 injections. No other significant adverse effects.

Mixed Neurological Populations

Abboud et al., 2019 [5]

- Minor adverse effects only: small haematomas, mild self-resolving dysphagia.

Oliveira et al., 2016 (literature review, ALS) [10]

- Concluded that adverse effects were minimal in most reports, though data were limited.

Ellies et al., 2004 (mixed conditions) [17]

- No major adverse effects across 33 patients.
- Occasional thicker saliva or delayed fistula closure.

General Neurorehabilitation Use

Intiso, 2012 (broad review) [13]

- Adverse effects usually infrequent and mild: injection-site reactions, dry mouth, transient dysphagia, autonomic symptoms.
- More severe effects (generalised weakness, significant dysphagia) seen mainly at higher doses or in vulnerable groups (e.g., children).



You asked

Original Query:

Title of search: Possible and likelihood of side effects and predicting factors for adverse side effects of treatment of Botulinum toxin injections for the treatment of hypersalivation in patients with progressive neurological conditions.

Explanation: We have had 2 patients in Southport with adverse reactions to botox injections for saliva management.

Alternative terminology: Hypersalivation, sialorrhea, excessive drooling.

Date range: None specified.

The Evidence

1. **Taubert S, Collins A, Henderson R, McCombe P, Tang L, Kramer K, Wishart L, Burns C. Co-Design and Non-Randomised Pilot Evaluation of Resources Developed to Optimise Saliva Management in People with Motor Neurone Disease. Healthcare (Basel). 2025 Nov 5;13(21):2813.**

The authors of this study set out to create and assess resources tailored for managing saliva-related symptoms in people with motor neurone disease (plwMND). It found that co-designed materials, combined with routine clinic follow-ups, supported plwMND in putting personalised saliva management plans into practice. Over half of participants (54%) maintained improvements for three months, most using non-invasive treatments. Both patients and community clinicians viewed the resources as useful.

Although it includes botulinum toxin injections as one of the medical saliva interventions with associated side effects, it doesn't mention specific adverse effects or go into detail on side effects in general.

The study was limited by its small and regionally confined sample, the absence of a control group, incomplete data for some participants, and possible biases linked to familiarity with the research team.



2025 Co-Design and
Non-Randomised Pilc



2. Yang CL, Huang JP, Tan YC, Wang TT, Zhang H, Qu Y. The effectiveness and safety of botulinum toxin injections for the treatment of sialorrhea with Parkinson's disease: a systematic review and meta-analysis. BMC Pharmacology and Toxicology. 2023 Oct 12;24(1):52.

This systematic review looked at the effectiveness and safety of botulinum toxin (BoNT) injections for treating sialorrhea in patients with Parkinson's disease. It included eight randomised controlled trials after screening 42 studies, assessing outcomes such as drooling severity and frequency, saliva composition, and adverse events. The main findings suggest that BoNT injections significantly reduce sialorrhea symptoms compared to placebo, with reported adverse events being common but manageable.

Mild adverse events included: dry mouth (most common), worsening gait, diarrhoea, difficulty swallowing, neck pain, and weak chewing, with recovery times of one to six weeks.

Serious adverse events reported included: atrial fibrillation, urinary sepsis, rectal bleeding (in the treatment group); and congestive heart failure, dyspnea, pneumonia (in the placebo group).

Limitations include some studies lacking detailed randomization and allocation concealment, difficulties in blinding due to dose differences, incomplete post-injection data in certain studies, and inclusion of conference abstracts and indirect data, all of which may affect the robustness of the conclusions.



2023 The effectiveness and safe

3. James E, Ellis C, Brassington R, Sathasivam S, Young CA. Treatment for sialorrhea (excessive saliva) in people with motor neuron disease/amyotrophic lateral sclerosis. Cochrane Database of Systematic Reviews. 2022 May 20;5(5):CD006981.

This paper evaluated treatments for sialorrhea in people with motor neuron disease (MND)/amyotrophic lateral sclerosis (ALS), focusing on clinical and statistical significance, trial design, and outcome measures.

The main findings pointed to several methodological challenges, including studies that were too small to test multiple treatment regimens effectively, problems keeping participants and researchers blinded because of noticeable treatment effects and side effects, and questions about the reliability of certain outcome measures, such as counting used paper handkerchiefs. More objective assessments, like measuring saliva volume with cotton roll weight, were recommended.



Adverse events: The review reported that there were nine adverse events in the botulinum toxin group and 10 in the placebo group, with no severe adverse events related to the treatment; in this review, botulinum toxin was not associated with increased aspiration pneumonia, dysphagia, or declining vital capacity.

The authors found a high risk of bias in some studies, a likelihood of unpublished negative results, recurring difficulties with blinding, and wide variation in study design, sample size, and outcome measures.



2022 Treatment for
sialorrhea.pdf

4. Shehee L, O'Rourke A, Garand KL. The Role of Radiation Therapy and Botulinum Toxin Injections in the Management of Sialorrhea in Patients With Amyotrophic Lateral Sclerosis: A Systematic Review. Journal of Clinical Neuromuscular Disease. 2020 Jun;21(4):205-221.

The authors systematically reviewed the effectiveness of interventions for sialorrhea in patients with amyotrophic lateral sclerosis (ALS), focusing on radiation therapy and botulinum toxin following the limited success and side effects of anticholinergic medications. The main findings indicated that both radiation therapy and botulinum toxin can be considered effective alternatives when medical management fails, providing symptomatic relief from sialorrhea.

Adverse events: Botulinum toxin was generally well tolerated but some patients experienced mild adverse events such as dry mouth, local pain, and difficulty chewing; more severe complications reported included recurrent temporomandibular joint dislocation and rapid deterioration in bulbar function.

The review highlighted limitations such as variability in study designs, small sample sizes, and potential side effects associated with these treatments, which limit the strength of the conclusions and highlight the need for further high-quality research.



2020 The Role of
Radiation Therapy an

5. Abboud WA, Nadel S, Hassin-Baer S, Arad A, Dobriyan A, Yahalom R. Ultrasound-Guided Botulinum Toxin Injections into the Salivary Glands for the Treatment of



Drooling. The Israel Medical Association Journal. 2019 Feb;21(2):116-119. PMID: 30772963.

This study examined how effective and safe ultrasound-guided botulinum toxin injections into the parotid and submandibular glands are for managing drooling in people with chronic neurological conditions. It found that 67% of participants experienced marked improvement, with benefits lasting an average of 4.5 months.

Adverse events: Reported adverse events were minor, including small local haematomas with residual ecchymosis that did not require medical care, and mild dysphagia that resolved spontaneously within one month without medical treatment.

Its retrospective design, the small cohort of 12 patients, the absence of a control group, and the use of mainly subjective outcome measures limit the strength of the evidence. Larger prospective studies exploring different dosing strategies are needed to verify these findings.



2019

Ultrasound-Guided Bc

6. Bernardo P, Raiano E, Cappuccio G, Dubbioso R, Bravaccio C, Vergara E, Peluso S, Manganelli F, Esposito M. The Treatment of Hypersalivation in Rett Syndrome with Botulinum Toxin: Efficacy and Clinical Implications. Neurology and Therapy. 2019 Jun;8(1):155-160.

The aim of this study was to evaluate the effectiveness of botulinum toxin treatment for hypersalivation in patients with Rett syndrome (RS) and to explore potential benefits on oral motor and respiratory functions. The main findings showed that botulinum toxin injections into salivary glands significantly reduced drooling severity and improved related symptoms such as eating habits and bruxism at four weeks post-treatment.

Adverse events: One patient experienced a temporary worsening of dysphagia for a few weeks after botulinum toxin treatment; no other adverse events or side effects were reported in the remaining patients.

However, the study was limited by its small sample size of only five patients and the short-term follow-up period, which may restrict the generalisability and long-term assessment of treatment efficacy.



2019 The Treatment
of Hypersalivation.pdf



7. Ruiz-Roca JA, Pons-Fuster E, Lopez-Jornet P. Effectiveness of the Botulinum Toxin for Treating Sialorrhea in Patients with Parkinson's Disease: A Systematic Review. Journal of Clinical Medicine. 2019 Mar 6;8(3):317.

This review set out to assess how effective botulinum toxin is for treating sialorrhea in adults with Parkinson's disease by reviewing clinical trials published from 2010 to 2017. The main findings indicate that botulinum toxin effectively reduces sialorrhea symptoms, with effects appearing around one-week post-injection and lasting 3–5 months, particularly when injections target the parotid and submandibular glands, often guided by ultrasonography to enhance safety. However, there is no consensus on the optimal injection sites, dosing, or follow-up durations. Limitations of the review include variable sample sizes, heterogeneity in study designs, inclusion of mixed neurological populations in some studies, and the need for larger, higher-quality trials with longer follow-up to confirm these results. This review doesn't detail any specific adverse events.



2019 Effectiveness of
the Botulinum Toxin.p

8. van Hulst K, Kouwenberg CV, Jongerius PH, Feuth T, van den Hoogen FJ, Geurts AC, Erasmus CE. Negative effects of submandibular botulinum neurotoxin A injections on oral motor function in children with drooling due to central nervous system disorders. Developmental Medicine and Child Neurology. 2017 May;59(5):531-537.

This paper aimed to determine the incidence and characteristics of adverse effects on oral motor function following initial injections of botulinum neurotoxin A (BoNT-A) into the submandibular glands for managing excessive drooling in children with central nervous system disorders, and to identify independent predictors of these adverse effects. The results showed that BoNT-A is generally effective, but a notable number of children experienced oral motor difficulties afterwards, with certain characteristics linked to increased risk.

Adverse events: mild, moderate, and severe changes in saliva swallowing, eating, drinking, and articulation, with eating problems being the most common; some cases also involved multiple co-occurring oral motor problems, increased saliva viscosity, and in severe cases, hospitalisation or significant feeding changes like tube feeding.

Limitations included a restricted sample size, differences in injection methods or patient profiles, and some dependence on subjective measures of oral motor function.



2017 Negative effects
of submandibular bot

9. Bruno VA, Fox SH, Mancini D, Miyasaki JM. Botulinum Toxin Use in Refractory Pain and Other Symptoms in Parkinsonism. The Canadian Journal of Neurological Sciences. 2016 Sep;43(5):697-702.

The aim of the study was to evaluate the usefulness and efficacy of botulinum toxin (BTX) injections in patients with idiopathic Parkinson's disease and atypical parkinsonian syndromes, particularly for symptom relief and quality of life improvement.

The main findings revealed that BTX treatment was predominantly used for pain relief (in over 50% of cases) and was effective, with 81% of patients reporting benefits after the first injection and sustained improvement over time. BTX also showed efficacy in managing dystonia-related functional impairment, sialorrhea, freezing of gait, and camptocormia. The treatment was found to be safe and beneficial even in advanced disease stages.

However, as a retrospective chart review relying on subjective Clinical Global Impression assessments, the study's limitations include potential selection bias, lack of a control group, and limited objective outcome measures, which could affect the generalisability and strength of the conclusions.

Adverse events: 11 minor local adverse effects were reported related to BTX injections (but the details of the adverse events weren't specified). All effects were reported as transient and mild; doses and injection patterns were adjusted to manage the effects.



2016 Botulinum Toxin
Use in.pdf

10. Oliveira AF Filho, Silva GA, Almeida DM. Application of botulinum toxin to treat sialorrhea in amyotrophic lateral sclerosis patients: a literature review. Einstein (Sao Paulo). 2016 Jul-Sep;14(3):431-434.

The authors reviewed existing research on alternative approaches for managing sialorrhea in people with amyotrophic lateral sclerosis (ALS), focusing on ultrasound-guided botulinum toxin injections. The evidence suggests that botulinum toxin effectively reduces excessive saliva with minimal side effects, potentially offering a promising option compared with anticholinergic medication or surgical procedures.



The review also highlights gaps in current knowledge, including limited data on the best injection methods and long-term outcomes. It recommends developing refined protocols and conducting larger clinical trials to define its full therapeutic value.



2016 Application of botulinum toxin to tre

11. Sillanpää S, Sipilä M, Numminen J, Rautiainen M. The Experience of Treating Drooling with Repeated Botulinum Toxin Injections. ORL Journal for Otorhinolaryngology and its Related Specialities. 2015;77(6):333-8.

This study aimed to assess the long-term use of repeated botulinum toxin A injections into the submandibular glands as a treatment for drooling in young patients with neurodevelopmental disorders. It found that most injections produced a good and sustained reduction in drooling, with an average effect lasting around five months, and complications were rare, with only one notable episode of swallowing difficulty among 41 injections.

Adverse events: The adverse event consisted of one case of transient swallowing difficulty (dysphagia) which resolved within a week. No other significant complications were recorded across the 41 injections reviewed.

The main limitations were the small sample size, the retrospective design, and a reliance on subjective reports.



2015 The Experience of Treating Drooling.f

12. Squires N, Humberstone M, Wills A, Arthur A. The use of botulinum toxin injections to manage drooling in amyotrophic lateral sclerosis/motor neurone disease: a systematic review. Dysphagia. 2014 Aug;29(4):500-8.

This systematic review evaluated the evidence for botulinum toxin injections as a treatment for drooling in people with ALS/MND. It found twelve small studies, most with modest methodological quality, showing that both botulinum toxin A and B can reduce saliva, with type B demonstrating more consistent and statistically significant benefits. However, the review highlighted a few limitations, including small sample sizes, heterogeneity of study designs, varied dosing and injection techniques, limited use of objective measures, and a lack of robust randomised controlled trials.



Adverse events:

The paper reports several adverse reactions to botulinum toxin injections, drawn from the studies included in the review. Reported effects vary by toxin type:

Botulinum toxin A: Adverse reactions were generally mild and infrequent. These included dry mouth, thickened/viscous saliva, and occasional discomfort; one study mentioned a patient required a feeding tube months later, although this could be due to disease progression rather than the injection.

Botulinum toxin B: These included dry mouth, thickened saliva, local pain, chewing weakness, subcutaneous haematoma, mouth bleeding, respiratory infections, facial paresis, eye irritation, and shortness of breath. Some studies also reported serious events such as pneumonia or respiratory difficulties, though these could not be clearly attributed to the toxin rather than ALS/MND progression.

The review notes that while botulinum toxin can reduce drooling, adverse effects can occur. They are mostly mild but occasionally can be more serious.



2014 The Use of
Botulinum Toxin Inject

13. Intiso D. Therapeutic use of botulinum toxin in neurorehabilitation. Journal of Toxicology. 2012;2012:802893.

This paper reviewed the therapeutic use of botulinum toxins A and B across a wide range of neurorehabilitation conditions. It found strong evidence that botulinum toxin A is effective for reducing focal spasticity and helpful in several other conditions, while botulinum toxin B has a narrower evidence base but may be useful when resistance to type A develops. The review also noted that benefits are often greatest when injections are combined with broader rehabilitation strategies. Key limitations include reliance on heterogeneous studies, variable dosing and injection techniques, limited long-term evidence, and the scarcity of high-quality randomised trials.

Adverse events: The paper states that adverse events are infrequent overall, but both local and systemic effects can occur. Local reactions include pain, redness, and swelling at the injection site, while remote effects can arise from toxin spread and can lead to autonomic symptoms or muscular weakness. Reported adverse events include nausea, urinary incontinence, falls, seizures, fever, dry mouth, dysphagia, and general malaise or flu-like symptoms. Most reactions are described as mild and transient. However, more severe events have been documented, especially in children given higher doses, such as



generalised weakness and severe dysphagia requiring hospital care. Systemic weakness distant from the injection site has also been reported, and repeated high-dose injections could increase the risk of significant adverse effects.



2012 Therapeutic Use
of Botulinum Toxin.pdf

14. Rodwell K, Edwards P, Ware RS, Boyd R. Salivary gland botulinum toxin injections for drooling in children with cerebral palsy and neurodevelopmental disability: a systematic review. *Developmental Medicine and Child Neurology*. 2012 Nov;54(11):977-87.

The authors of this systematic review aimed to evaluate how effective and safe botulinum toxin injections to the salivary glands are for managing drooling in children with cerebral palsy and neurodevelopmental disability. It found consistent evidence across 16 studies that botulinum toxin reduces drooling, with improvements shown on validated scales such as the Drooling Impact Scale and Drooling Frequency and Severity Scale, as well as reductions in daily bib use.

Adverse events: Adverse events were found in 2–41% of cases, including dysphagia, thickened saliva, and, rarely, aspiration pneumonia, and one trial was stopped early because of safety concerns.

The review's limitations include considerable heterogeneity in study design, dosing, injection sites, and outcome measures, inconsistent reporting of adverse events, and a small number of high-quality randomised trials.



2012 Salivary gland
botulinum toxin.pdf

15. Meijer JW, van Kuijk AA, Geurts AC, Schelhaas HJ, Zwarts MJ. Acute deterioration of bulbar function after botulinum toxin treatment for sialorrhoea in amyotrophic lateral sclerosis. *American Journal of Physical Medicine and Rehabilitation*. 2008 Apr;87(4):321-4.

This study described a case of acute and severe worsening of bulbar function in a woman with bulbar-onset ALS following botulinum toxin injections for sialorrhoea, and to review previous reports of similar complications. It found that the patient experienced rapid deterioration (progressing within days to complete loss of swallowing and speech) despite



ultrasound-guided injections, and that earlier studies, though initially reporting good tolerance, have since documented complications such as jaw dislocation, facial weakness, tongue swelling, and impaired swallowing.

The main limitations include the single-case design, which restricts generalisability, uncertainty about dose equivalence between toxin formulations, variability in injection techniques across studies, and the difficulty of distinguishing true treatment-related effects from ALS disease progression.



2008 Acute
Deterioration of Bulb:

16. Verma A, Steele J. Botulinum toxin improves sialorrhoea and quality of living in bulbar amyotrophic lateral sclerosis. *Muscle Nerve*. 2006 Aug;34(2):235-7. [Clinical trial].

The authors of this study aimed to investigate whether small doses of botulinum toxin A injected into the parotid glands could reduce socially disabling sialorrhoea and improve daily functioning in people with bulbar ALS. It found that over half of the ten participants experienced a meaningful reduction in drooling, reflected by decreased tissue use, lower drooling impact scores, and improved subjective ratings, with benefits typically lasting two to three months. No major adverse effects were observed, and bulbar function remained stable during follow-up, although one patient required a feeding tube months later due to disease progression. Key limitations include the very small sample size, the uncontrolled open-label design, lack of blinding, and the use of an unvalidated quality-of-life scale.



2006 Botulinum Toxin
Improves.pdf

17. Ellies M, Gottstein U, Rohrbach-Volland S, Arglebe C, Laskawi R. Reduction of salivary flow with botulinum toxin: extended report on 33 patients with drooling, salivary fistulas, and sialadenitis. *Laryngoscope*. 2004 Oct;114(10):1856-60.

This study aimed to evaluate the effectiveness, duration of benefit, and safety of botulinum toxin A injections into the salivary glands for reducing salivary flow in patients with drooling, salivary fistulas, or chronic sialadenitis. It found that 79% of the 33 patients reported clear symptomatic improvement, with salivary flow and thiocyanate output falling sharply within a week and typically returning to baseline after 12–16 weeks; most patients experienced



benefit for around three months, though some required reinjection at 4–7 months. No major adverse effects or pathological gland changes were observed, and only occasional issues such as thicker saliva or delayed fistula closure were reported. Limitations include the retrospective design, heterogeneous patient population, lack of control group, reliance on subjective assessments for many outcomes, and variable follow-up intervals, which limit the precision and generalisability of the findings.



2004 Reduction of Salivary Flow.pdf

18. Mancini F, Zangaglia R, Cristina S, Sommaruga MG, Martignoni E, Nappi G, Pacchetti C. Double-blind, placebo-controlled study to evaluate the efficacy and safety of botulinum toxin type A in the treatment of drooling in parkinsonism. *Movement Disorders*. 2003 Jun;18(6):685-8. [Clinical trial].

The authors aimed to determine whether botulinum toxin type A is an effective and safe treatment for drooling in people with parkinsonism by conducting a double-blind, placebo-controlled trial. It found that a single ultrasound-guided injection of 450 units into the parotid and submandibular glands significantly reduced drooling severity and frequency at one week compared with placebo, although the effect had largely worn off by three months. No adverse effects were observed, and the technique appeared well tolerated. Limitations include the small sample size, short follow-up, reliance on clinical rating scales rather than objective salivary measures, and the use of a single fixed dose.



2003 Double-Blind, Placebo-Controlled.pc

Indicative search strategy

“Botulinum toxin injection*” OR “botox injection*” OR “BTX injection*”

AND

Hypersalivation OR “excessive drool*” OR “excessive saliva” OR sialorrhoea OR sialorrhoea OR “oral secretion*” OR saliva OR “salivary gland*” OR “saliva management” OR “manag* saliva” OR “salivary flow”

AND

“Progressive neurological condition*” OR “progressive neurological disorder*” OR “progressive neurological disease*” OR “neurodegenerative disease*” OR dementia OR Alzheimer's OR Parkinson's OR Parkinsonism OR “motor neuron disease*” OR “MND” OR



Huntington’s OR “multiple system atrophy” OR “MSA” OR “progressive supranuclear palsy” OR “PSP” OR “Rett syndrome” OR “Amyotrophic Lateral Sclerosis” OR “ALS” OR neurorehabilitation

AND

Risk* OR harm* OR danger* OR complication* OR “side effect*” OR “risk factor*” OR “adverse effect*” OR “adverse reaction*” OR “adverse drug reaction” OR “adverse event*” OR “negative consequence*” OR safety OR “clinical implication*”

Sources searched

BMJ, CINAHL, Cochrane Library, Embase, Emcare, MEDLINE, Psychology and Behavioral Sciences Collection, PsycInfo, PubMed.

A structured public domain search for unpublished research.

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