THE LANCET

Supplementary appendix

Supplement to: Novak I, Jackman M, Finch-Edmondson M, Fahey M. Cerebral palsy. *Lancet* 2025; published online June 20. https://doi.org/10.1016/S0140-6736(25)00686-5.

Cerebral Palsy Seminar: Plain Language Summary

What is it?

Cerebral palsy is a lifelong condition affecting movement and posture.

Diagnosis

In the past, cerebral palsy was usually diagnosed after a baby missed developmental milestones or had abnormal reflexes. This often led to a late diagnosis and missed chances for early intervention, especially during the brain's critical period of development.

Today, it's possible to diagnose cerebral palsy as early as 3 months of age by using a combination of tests.

For babies under 5 months old, the most accurate tests are:

- MRI (brain scan) to check for damage in the area that controls movement (about 86% accurate)
- General Movements Assessment (GMA), which looks at the baby's natural movements (about 98% accurate)
- Hammersmith Infant Neurological Examination (HINE), which checks reflexes and posture (about 90% accurate)

Using all three tests together gives a very accurate diagnosis—up to 98% accuracy.

For babies over 5 months old, doctors use:

- MRI
- HINE
- A parent checklist, called the Developmental Assessment of Young Children (DAYC), to track changes in development over 6 months

In places where this early diagnosis guideline is used, the average age of diagnosis has dropped from 19 months to just 6 months, helping babies get the support they need much earlier.

Key takeaway

New tools for early diagnosis have changed how cerebral palsy is detected. Babies can now be diagnosed much earlier, which means they can start therapy sooner—and that can lead to better outcomes as they grow.

How is cerebral palsy classified?

Cerebral palsy can look very different from person to person. That's why it's important to classify it—this helps the team understand what to expect, choose the right treatments, and plan care. Cerebral palsy is usually described by movement type, which parts of the body are affected, and how it impacts daily abilities.

Motor Types

Cerebral palsy affects movement in different ways:

- Spasticity is the most common type, affecting about 84% of people. It causes stiff or tight muscles.
- Dyskinesia (about 9%) includes movements that are uncontrolled or unpredictable, such as twisting (dystonia), writhing (athetosis), or sudden movements (chorea).
- Ataxia (4%) affects balance and coordination.
- Hypotonia (3%) means low muscle tone, or "floppiness."
- Many people have a mix of movement types, which is now more widely recognised.

Body Regions Affected

Cerebral palsy can affect different parts of the body:

- Unilateral (41%): One side of the body is affected, like an arm and leg on the same side.
- Bilateral (59%): Both sides are affected, which is more common in people with dyskinetic, ataxic, or hypotonic types.
- Some countries also use terms like:
  - Hemiplegia (41%) – one side of the body.
  - Diplegia (36%) – mainly the legs.
  - Quadriplegia (23%) – all four limbs.

Ability level

Five tools classify abilities into five levels, from mildest (Level I) to most severe (Level V):

- Gross Motor Function Classification System (GMFCS).
- Manual Abilities Classification System (MACS).
- Communication Function Classification System (CFCS).
- Eating and Drinking Ability Classification System (EDACS).
- Visual Function Classification System (VFCS).

Comorbidities

Up to 95% of people with cerebral palsy have additional conditions:

- Chronic pain (75%).
- Intellectual disability (50%).
- Hip displacement (33%).
- Epilepsy (25%).
- Sleep disorders (20%).
- About 1 in 2 people with cerebral palsy have a visual impairment. Conditions like strabismus (crossed or misaligned eyes) affect 60%, and cerebral visual impairment (CVI)—a problem with how the brain processes vision—affects about 20%. These are more common in people with bilateral cerebral palsy who have difficulty walking.

Key takeaway

9 out of 10 people with cerebral palsy have other health conditions that can be just as challenging as movement difficulties. Spotting these early and managing them throughout life is key to improving quality of life.

Purpose of the review

This review answers common questions asked by people with cerebral palsy, using the best available evidence.

To do this, we searched medical research databases from January 1, 2013, to November 30, 2024. We included only high-quality studies that focused on the questions people with cerebral palsy said were most important in research priority-setting projects.

How common is cerebral palsy?

Cerebral palsy is becoming less common in high-income countries, with rates dropping by 40% over the past 15 years—from about 1 in 400 to 1 in 700 babies. In low- and middle-income countries (LMICs), it remains more common, affecting around 1 in 300 babies.

What causes cerebral palsy?

Cerebral palsy is usually caused by brain injury or abnormal brain development before, during, or shortly after birth. For most people (94%), it begins during pregnancy or birth, while a smaller number (6%) are affected after birth but before age two.

Before and during pregnancy:

Certain maternal health conditions—such as thyroid disease, epilepsy, or intellectual disability—as well as young maternal age, low income, multiple pregnancies, or infections (like rubella, CMV, or Zika virus) can increase the risk.

Around the time of birth:

Premature birth, low birth weight, and complications such as lack of oxygen or infections (like jaundice or meningitis) can also raise the risk.

After birth:

Cerebral palsy may also result from severe infections, strokes, seizures, or head injuries—particularly during the first two years of life.

Key takeaway

Preventing cerebral palsy means managing risks during pregnancy, birth, and early infancy. Good medical care and health education can make a big difference in lowering those risks.

Genetics and cerebral palsy

For up to 30% of people with cerebral palsy, genetics plays a major role. Genes involved in brain development, movement control, and cell communication can contribute to cerebral palsy—often interacting with complications during pregnancy or birth.

New types of genetic testing, like exome and genome sequencing, are changing how cerebral palsy is diagnosed and managed. These tests can lead to earlier diagnosis and more targeted treatment. For example, people with certain genetic types of dyskinesia may benefit from deep brain stimulation, while others with metabolic conditions may respond well to specific supplements.

Key takeaway
Advances in genetics are opening the door to personalised care and new treatment options, making this a promising and rapidly growing area in cerebral palsy research.

What is the life expectancy for people with cerebral palsy?

Thanks to advances in medical care, life expectancy for people with cerebral palsy has improved greatly over the past 20 years.

Most people with cerebral palsy now live into late adulthood, although not as long as the general population. Those with severe physical disabilities or intellectual disabilities may have a shorter life expectancy. Some are also at higher risk of early death from health problems like pneumonia or heart disease.

Key takeaway
Most people with cerebral palsy live into adulthood, highlighting the importance of preventive health care—such as managing eating and drinking difficulties (like dysphagia) and supporting active, healthy lifestyles.

Can cerebral palsy be prevented?

The rate of cerebral palsy is going down, thanks to better care and public health measures. Some key treatments that help reduce the risk include:
- Magnesium sulphate for pregnant women at risk of early (premature) labour
- Corticosteroids during pregnancy to help the baby’s lungs
- Therapeutic cooling (also called hypothermia treatment) for newborns with brain injury
- Caffeine for premature babies with breathing problems

Other important strategies include better pregnancy care (like ultrasounds), early testing for metabolic conditions, improved care for newborns, and public health measures such as using one embryo during IVF and handwashing to prevent infections.

Key takeaway
With the right interventions at the right time, some instances of cerebral palsy can be prevented.

How does poverty affect cerebral palsy?

Cerebral palsy is more common and often more severe in families with fewer resources. In low- and middle-income countries, children with cerebral palsy are more likely to have serious physical disabilities because of higher rates of infection, limited pregnancy care, and less access to therapies and equipment.

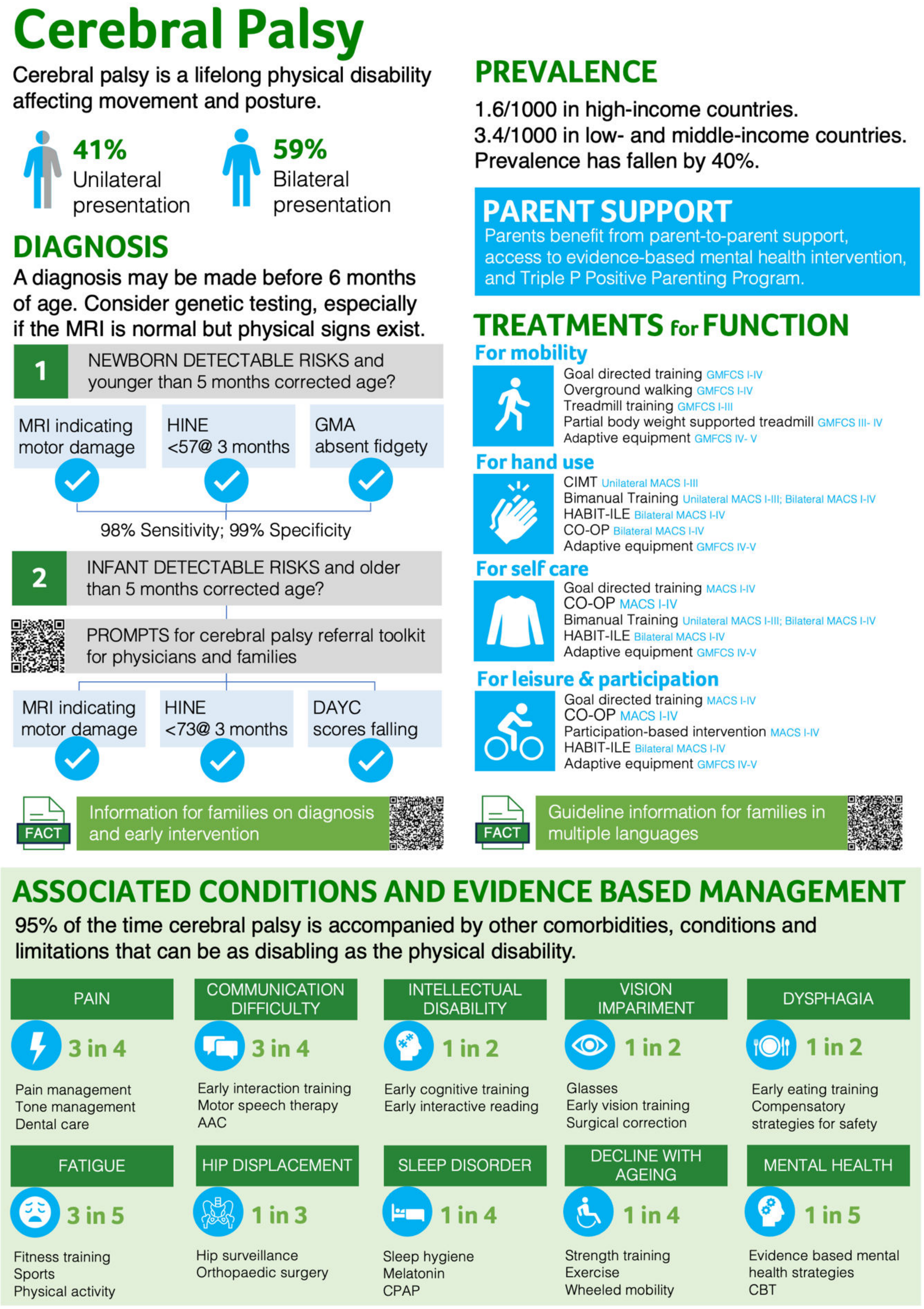
For example, in high-income countries, 58% of children with cerebral palsy can walk, while in lower-income countries, only 27% can. Even in wealthier countries, children from low-income families are more likely to have more severe disabilities and other health challenges.

Key takeaway
Cerebral palsy is more common and more severe among children in poorer families or countries. Improved healthcare, policies, and community support can help reduce this gap.

TREATMENT OPTIONS

Multiple evidence-based interventions are available and summarised in Figure 1.

Figure 1: Diagnosis and Treatment Overview



Cerebral Palsy

Cerebral palsy is a lifelong physical disability affecting movement and posture.

41% Unilateral presentation

59% Bilateral presentation

DIAGNOSIS

A diagnosis may be made before 6 months of age. Consider genetic testing, especially if the MRI is normal but physical signs exist.

1 NEWBORN DETECTABLE RISKS and younger than 5 months corrected age?

- MRI indicating motor damage ✓
- HINE <57@ 3 months ✓
- GMA absent fidgety ✓

98% Sensitivity; 99% Specificity

2 INFANT DETECTABLE RISKS and older than 5 months corrected age?

PROMPTS for cerebral palsy referral toolkit for physicians and families

- MRI indicating motor damage ✓
- HINE <73@ 3 months ✓
- DAYC scores falling ✓

FACT Information for families on diagnosis and early intervention

PREVALENCE

1.6/1000 in high-income countries.
3.4/1000 in low- and middle-income countries.
Prevalence has fallen by 40%.

PARENT SUPPORT

Parents benefit from parent-to-parent support, access to evidence-based mental health intervention, and Triple P Positive Parenting Program.

TREATMENTS for FUNCTION

For mobility

- Goal directed training GMFCS I-IV
- Overground walking GMFCS I-IV
- Treadmill training GMFCS I-III
- Partial body weight supported treadmill GMFCS III- IV
- Adaptive equipment GMFCS IV- V

For hand use

- CIMT Unilateral MACS I-III
- Bimanual Training Unilateral MACS I-III; Bilateral MACS I-IV
- HABIT-ILE Bilateral MACS I-IV
- CO-OP Bilateral MACS I-IV
- Adaptive equipment GMFCS IV-V

For self care

- Goal directed training MACS I-IV
- CO-OP MACS I-IV
- Bimanual Training Unilateral MACS I-III; Bilateral MACS I-IV
- HABIT-ILE Bilateral MACS I-IV
- Adaptive equipment GMFCS IV-V

For leisure & participation

- Goal directed training MACS I-IV
- CO-OP MACS I-IV
- Participation-based intervention MACS I-IV
- HABIT-ILE Bilateral MACS I-IV
- Adaptive equipment GMFCS IV-V

FACT Guideline information for families in multiple languages

ASSOCIATED CONDITIONS AND EVIDENCE BASED MANAGEMENT

95% of the time cerebral palsy is accompanied by other comorbidities, conditions and limitations that can be as disabling as the physical disability.

PAIN	COMMUNICATION DIFFICULTY	INTELLECTUAL DISABILITY	VISION IMPARIMENT	DYSPHAGIA
3 in 4	3 in 4	1 in 2	1 in 2	1 in 2
Pain management Tone management Dental care	Early interaction training Motor speech therapy AAC	Early cognitive training Early interactive reading	Glasses Early vision training Surgical correction	Early eating training Compensatory strategies for safety
FATIGUE	**HIP DISPLACEMENT**	**SLEEP DISORDER**	**DECLINE WITH AGEING**	**MENTAL HEALTH**
3 in 5	1 in 3	1 in 4	1 in 4	1 in 5
Fitness training Sports Physical activity	Hip surveillance Orthopaedic surgery	Sleep hygiene Melatonin CPAP	Strength training Exercise Wheeled mobility	Evidence based mental health strategies CBT

LEGEND: AAC = Augmentative and Alternative Communication; CBT = Cognitive Behaviour Therapy; CO-OP = Cognitive Orientation to Occupational Performance (problem solving intervention); CPAP = Continuous Positive Airway Pressure; DAYC = Developmental Assessment of Young Children (developmental checklist); GMFCS = Gross Motor Function Classification System; GMA = General Movements Assessment (scored video-assessment of baby's quality of movement); HABIT-ILE = Hand Arm Bimanual Intensive Training Including the Lower Extremity; HINE = Hammersmith Infant Neurological Examination (scored neurological assessment); MACS = Manual Ability Classification System; MRI = Medical Resonance Imaging; Triple P = Positive Parenting Program (parent education program for managing children's behaviour positively.

TREATMENTS FOR INFANTS

What are the safest and most effective seizure medications for newborns?

Seizures in newborns can be an early sign of brain injury and may increase the risk of further damage or developmental delays. Around 30% of people with cerebral palsy also have epilepsy, although some improve over time.

Treatments for seizures

Phenobarbital is the most commonly used medication for newborn seizures. However, because of concerns about its effects on brain development, other options like levetiracetam and benzodiazepines are being explored. Levetiracetam shows promise, but it's still unclear whether it is better than phenobarbital.

Key takeaway

Fast diagnosis and treatment of seizures are essential. More research is needed to find safer and more effective options for newborns.

Can early therapy help?

Yes—early therapy can improve outcomes for children with cerebral palsy. New guidelines recommend starting therapy as early as possible, ideally before 6 months of age, to build skills, prevent complications, and support parents.

What Works Best?

- Movement skills: Task-specific training (practicing real activities the baby wants to do) helps all types of cerebral palsy. For children with one-sided movement challenges, therapies like CIMT and bimanual training improve hand use.
- Thinking skills: Reading stories with family members, along with access to toys, environments, and opportunities that encourage problem-solving, supports thinking skills in all types of cerebral palsy.
- Communication: Coaching parents or caregivers to support communication can be helpful.
- Feeding: Training to support safe eating and drinking shows promise, but more research is needed.

Key takeaway

Starting therapy early—especially before 6 months—can improve motor and hand skills and may also help with feeding and communication. Early diagnosis is key to getting support on time.

What helps improve thinking and learning?

Nearly half of people with cerebral palsy have intellectual disabilities, especially those with severe physical disabilities, epilepsy, or brain injuries. Challenges with memory, attention, and planning are also common.

What Can Help?

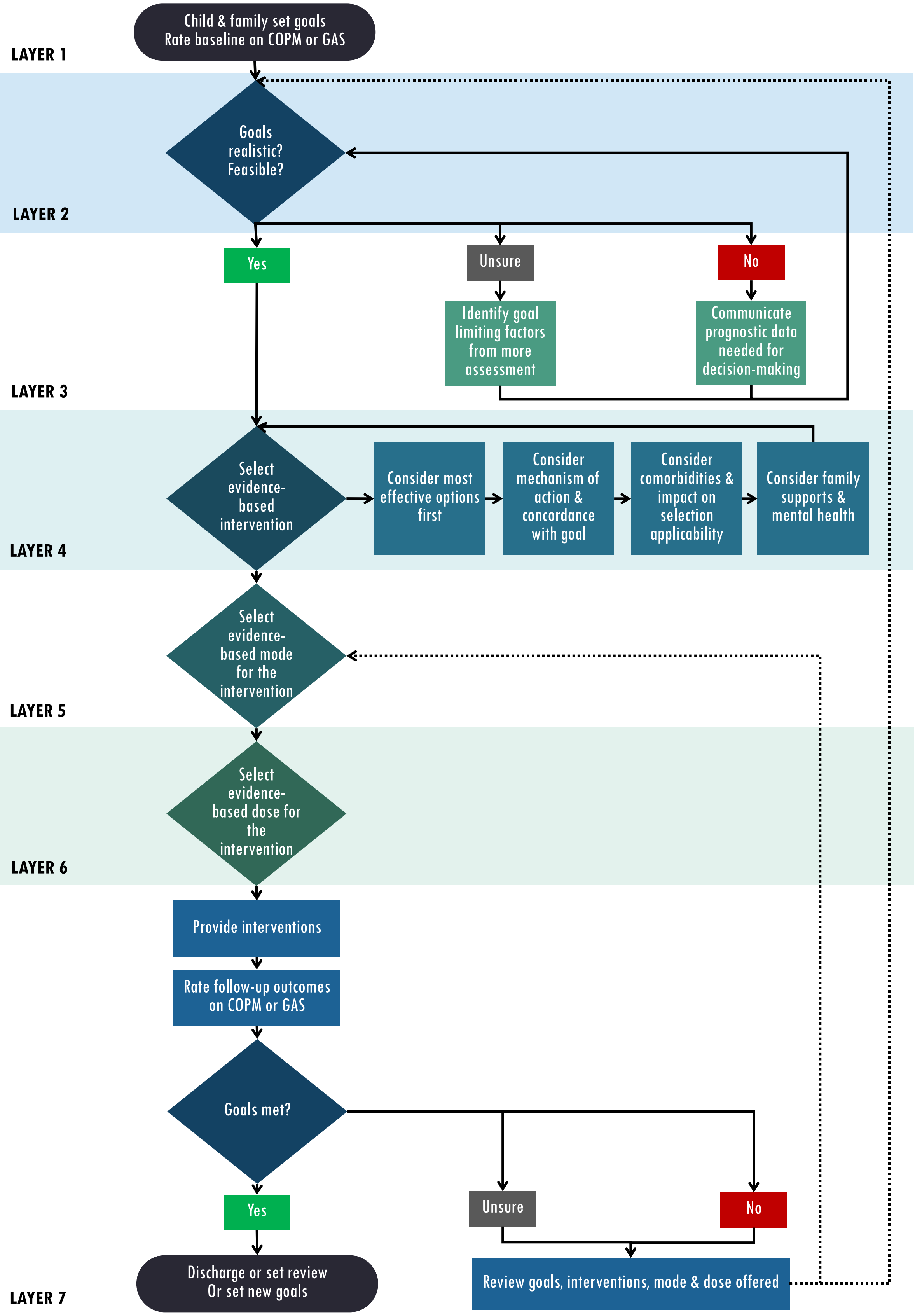
- Cognitive training: Activities like cause-and-effect toys, social games, and child-led play support development.
- Environment: Adapting toys and tasks to the child's abilities, along with reading stories and early education, is important.
- Assistive technology: Customised tools and technology like “touch screen tablets” can help children learn and explore independently.

Key takeaway

Early support for thinking and learning—through play, technology, and education—is just as important as physical therapy for children with cerebral palsy.

Supplementary File

Figure 2: READ model



TREATMENTS FOR CHILDREN

What are the best treatments for children?

The first step in choosing the right treatment is understanding the goals of the child and their family. Treatments should target these goals directly, and sometimes combining approaches works best. Regularly checking progress helps ensure the chosen treatment is working toward the goal. The Rehabilitation Evidence-Based Decision-Making (READ) model (Figure 2) can help guide this process.

What works for movement skills?

- Hand Use: Home Programs, Goal-Directed Training, CIMT, Bimanual Therapy, Occupational Therapy with Botulinum Toxin-A (BOTOX or Dysport), Action Observation Training, and environmental enrichment.
- Movements skills: Task-Specific Training, Mobility Training, Treadmill Training, and environmental enrichment.

Assistive Equipment

For children with more severe physical disabilities, adaptive equipment and technology can help improve independence.

Key Takeaway

Tools like the traffic light papers can guide families and clinicians in choosing the best options. The most effective treatments are "green light" options that directly target improvements aligned with the child's and family's goals.

Which interventions improve independence and participation?

To help children with cerebral palsy become more independent and take part in everyday life, it's important to focus on real-life activities—not just body movement or physical challenges.

The most effective therapies are those that directly support participation and are practiced in everyday environments. They address real barriers—such as attitudes or inaccessible spaces—not just the person's physical disability. For example, a 12-week program that took place in the child's everyday settings and worked on physical, social, and environmental barriers led to better participation and progress toward personal goals.

Best interventions for function and participation

Some therapies can help children with cerebral palsy do more for themselves and take part in everyday life:

- Mobility: Walking-focused therapies like Overground Walking Training, Treadmill Training, Body Weight Supported Treadmill Training, and Goal-Directed Training help improve movement.
- Hand use: Therapies such as Constraint-Induced Movement Therapy (CIMT), Bimanual Training, and HABIT-ILE help improve how children use their hands.
- Self-care: Programs like CO-OP, Goal-Directed Training, and HABIT-ILE help children learn skills like dressing and eating.
- Assistive devices and technology: These tools help children be more independent and reduce stress on caregivers, especially for those with more severe physical challenges (GMFCS IV–V).
- Social skills groups: These may help children interact with others, but we're not yet sure how much they improve participation in daily life.

Key takeaway

To build independence and participation, choose evidence-based therapies that match the child's goals. Practice should focus on real-life activities, in real-life environments, and help remove physical, social, and environmental barriers.

What is the best therapy intensity?

We don't yet know the perfect amount of therapy, but short, focused periods of goal-based therapy often work well. The therapy must also be the right one—more hours won't help if the approach isn't effective. Parents can support extra practice at home to boost progress.

What do we know?

- Hand use: Three or more sessions per week give better results. Goal-based programs like CO-OP need 14–25 hours, while CIMT and bimanual training need 30–40 hours.
- Movement: Movement improves with more than three sessions per week.

Therapy should be matched to the child's goals, abilities, and family routine. Regular, meaningful practice makes the biggest difference.

Key takeaway

The right intensity depends on the therapy and the child's goals. Start by choosing the goal, then decide on the best therapy and how much is needed to reach it.

What are the best ways to educate caregivers?

Caregiver support plays a big role in a child's development. The best caregiver education doesn't just give information—it includes coaching, builds confidence, and focuses on what matters most to each family.

What works best?

- Programs like Stepping Stones Triple P (Positive Parenting Program) and Acceptance and Commitment Therapy (ACT) improve caregiving skills, child development, and caregiver mental health.
- Coaching helps strengthen the caregiver-child relationship and supports learning and growth.
- Clinicians should build trust, set goals together with families, and support flexible, caregiver-led plans that match each family's strengths and needs.

Key takeaway

Caregiver education works best when it's tailored, builds trust, and empowers families through coaching and support.

What are the best medications for managing hypertonia?

Medications can help reduce spasticity (stiff muscles) and dystonia (involuntary twisting movements), but they work best when combined with therapy and clear, realistic goals set with the family.

Spasticity and Dystonia Management

Spasticity (stiff muscles):

- Focal tone (specific areas): Botulinum Toxin-A (BOTOX or Dysport) is often the first choice because it targets problem areas without affecting the whole body.
- Global tone (whole body): Baclofen is commonly used, starting as a tablet and sometimes delivered through a pump for better results. Other options include Diazepam, Selective Dorsal Rhizotomy (SDR), and Intrathecal Baclofen (ITB).

Dystonia (involuntary movements):

- ITB and Deep Brain Stimulation may help.
- Oral medications like Baclofen, Benzodiazepines, Clonidine, and Gabapentin are also used.

Other Benefits:

Botulinum toxin can also reduce dribbling, which can help with comfort and confidence in social situations.

Key takeaway

Medications for hypertonia can help, but they don't guarantee better function. For the best results, combine them with Goal-Directed Training and make sure treatments reflect the family's goals.

What are the best ways to improve sleep?

Sleep problems affect nearly 1 in 4 people with cerebral palsy and often begin in infancy. Common issues include trouble falling asleep, obstructive sleep apnoea

(OSA), and waking from muscle spasms. Poor sleep can affect development, increase behaviour challenges, and impact the whole family's well-being.

First Steps to Improve Sleep

- Good sleep habits: Avoid screens and energetic activity before bed.
- Melatonin: May help, especially in children with visual impairments. It should be used with care, considering family preferences and local medication safety guidelines.

Managing Specific Sleep Problems

- Obstructive Sleep Apnoea (OSA): A referral to a sleep specialist is recommended. Treatments may include CPAP (which is often hard to tolerate) or surgery such as removal of the tonsils.
- Waking from spasms: Medicines like Baclofen or Botulinum Toxin-A (BOTOX or Dysport) can reduce spasms and improve sleep.
- Sleep positioning systems: Often used to help with comfort and body alignment, but they haven't been shown to improve sleep. They are not recommended for infants due to safety concerns.

Key takeaway
Sleep can be improved with good routines, melatonin, and targeted treatments like BOTOX or surgery for apnoea. It's important to choose the right strategies based on the person's specific needs and health risks.

How can complications be prevented or minimised?

In high-income countries, 2 in 3 people with cerebral palsy develop bone and joint problems that can cause pain and breathing issues. These problems may be even more common in low-income settings due to more severe physical disabilities.

What helps prevent complications?

- Postural management: Starting early and continuing for life helps prevent deformities in children with higher support needs (GMFCS III–V).
- Hip surveillance: Regular hip checks from 12 months of age reduce the risk of hip dislocation in children with severe movement difficulties.
- Scoliosis surgery: Helps reduce spinal curve, pain, and skin issues in children at GMFCS IV–V.

Other helpful interventions

- Multilevel orthopaedic surgeries to correct joint and muscle problems.
- Serial casting and splints to help with alignment and muscle stretching.
- Standing frames to support mobility and encourage social interaction.

Key takeaway
Early hip checks and good posture care help prevent or minimise complications. Timely treatment can make a big difference in comfort, function, and health.

TREATMENTS FOR ADULTS

What happens as adults with cerebral palsy age, and how can we prevent decline?

People with cerebral palsy often reach their best movement ability during adolescence, but about 1 in 4 adults with cerebral palsy experiences a decline in walking—especially those at GMFCS levels III–V. This decline is linked to pain, fatigue, less physical activity, and fear of falling. Many adults choose wheeled mobility to save energy.

Adults with cerebral palsy also have a higher risk of developing long-term health conditions such as epilepsy, stroke, high blood pressure, heart disease, arthritis, and osteoporosis. These health issues can lead to even less movement, making mobility challenges worse.

How to prevent decline

- Orthopaedic care: Preventing joint problems helps maintain movement.

- Strength training: Builds muscle, improves walking, and helps with mobility.
- Exercise: Regular, high-intensity activity—like swimming—may help prevent physical decline, especially in those with more severe disabilities.
- Preventive care: Annual check-ups and health monitoring are key to catching and managing new issues early.

Key takeaway

Mobility decline is common in adults with cerebral palsy, but it can be reduced. Ongoing orthopaedic care, strength training, tailored exercise, and regular health checks can help adults stay active and maintain a better quality of life.

TREATMENTS ACROSS THE LIFESPAN

What are the best strategies to support communication?

By age five, 4 out of 5 children with cerebral palsy have delayed or unclear speech and may need extra support to communicate.

Early support

- Caregiver-child communication programs, like Hanen It Takes Two to Talk, help preverbal children develop non-verbal communication skills.
- AAC (Augmentative and Alternative Communication)—such as speech-generating devices (SGDs) or eye gaze technology—can support communication when started early.

Speech interventions

- Motor speech therapies, like intensive dysarthria therapy and PROMPT, can improve how clearly and accurately a child speaks.
- Speech Intelligibility Treatment helps children be better understood and take part in conversations.

Literacy support

- Reading stories together—even in the NICU—helps build thinking and language skills.
- Direct reading instruction supports literacy for children using AAC.

Key takeaway

Most children with cerebral palsy benefit from communication support. Speech therapies and AAC help improve communication and inclusion when tailored to each child's needs. Starting early makes a big difference.

What are the best eating and drinking interventions?

About 1 in 2 people with cerebral palsy have trouble swallowing, which can lead to food entering the lungs (causing pneumonia), poor nutrition, dehydration, and lower quality of life. Those with more severe physical disabilities are most at risk.

How to manage swallowing problems

- Compensatory strategies: Simple techniques, like thickening liquids, are commonly used to make swallowing safer.
- Skill training: Actively teaching eating and drinking skills during early development shows promise.
- For adults: It's important to regularly check for changes in swallowing so any issues can be managed early and safely.

Key takeaway

Swallowing difficulties are common in cerebral palsy. Early identification and proper management are key to staying healthy and supporting growth and learning.

How can emotional well-being be best managed?

Mental health challenges

- Children: Around 1 in 3 children with cerebral palsy have a mental health condition, like anxiety or depression.

About 1 in 4 also experience behaviour challenges, often linked to poor sleep and pain.
- Adults: Adults with cerebral palsy are more likely to experience mental health issues such as depression, anxiety, and mood disorders.
- Parents: Caregiving can be overwhelming—especially for mothers—who are twice as likely to experience depression and anxiety.

What can help?

- For children and caregivers: Positive parenting programs like Stepping Stones Triple P can improve child behaviour and reduce stress, anxiety, and depression in parents (Moderate Certainty; Green light).
- For adults: Exercise can help improve mood in the short term.

While mental health support in cerebral palsy is under-researched, people with CP are likely to benefit from proven strategies used in the general population.

Key takeaway

Mental health challenges are common in cerebral palsy. Regular screening, managing pain and sleep, and providing evidence-based support for individuals and families can make a big difference in emotional well-being.

What improves quality of life for people with cerebral palsy?

People with cerebral palsy can have a good quality of life, but it's important to ask about their experience rather than make assumptions. Many report lower physical quality of life, often linked to their level of physical disability. Other factors like pain, fatigue, sleep problems, mental health challenges, social exclusion, and low income can also lower quality of life. Children in low- and middle-income countries often experience poorer physical quality of life than their peers in wealthier countries.

What can help?

- Managing pain, sleep, and mental health improves both physical and emotional well-being.
- Social inclusion and family support help reduce isolation.
- Treatments for dystonia, like Intrathecal Baclofen (ITB) and deep brain stimulation, may improve comfort and movement.
- Policy and accessibility, including adaptive equipment and inclusive environments, can support independence and mobility.

Key takeaway

Improving quality of life means addressing both physical and emotional needs. Managing health issues, supporting inclusion, and making environments more accessible all make a real difference.

How can pain and fatigue be managed effectively?

Pain in cerebral palsy

Up to 73% of people with cerebral palsy experience pain, and it becomes more common with age. Pain is often linked to severe physical disability, high muscle tone, joint or dental issues, or physical activity. It can disrupt sleep (36%) and limit daily activities (61%), lowering quality of life. Good dental care is especially important, as oral health problems are more common.

Pain management

- Muscle-related pain: Intrathecal Baclofen (ITB) can reduce pain and improve well-being. Other treatments, like botulinum toxin or gabapentin, may help but need more research.
- After surgery: Medicines like bupivacaine, popliteal blocks, and botulinum toxin are recommended.
- During procedures: Distraction, imagery, or psychological preparation may help, but more evidence is needed.

Fatigue in cerebral palsy

Fatigue affects many people with cerebral palsy, especially those at GMFCS levels III–V (39%). It is closely linked to pain, quality of life, and the ability to live independently. The causes of fatigue aren't well understood and need more research.

Fatigue management

- Combining fitness training with lifestyle coaching to increase daily activity and participation in sports may help reduce fatigue.
- Because fatigue varies from person to person, individual assessment is important.

Key takeaway

Pain and fatigue are common and can greatly affect daily life. Regular screening and personalised, evidence-based treatment plans are key to improving comfort and quality of life.

What are the best exercise strategies for people with cerebral palsy?

Children with cerebral palsy are about 30% less active than their peers, but regular exercise has many health benefits. Aerobic exercise can improve movement skills, while resistance training is less effective. Exercise is safe and fits with health advice to stay active and limit long periods of sitting.

For children

- Guidelines: Aim for moderate exercise (that raises the heart rate) for 20 minutes, 2–3 times a week.
- Tips: Make physical activity part of everyday life. Choose fun, family-friendly activities that are easier to stick with over time.

For adults

- Guidelines: Talk with health professionals about the benefits of staying active and explore local, accessible options.
- Tips: Music therapy with rhythm may improve walking speed. Interactive games may help improve balance.

Key takeaway

People with cerebral palsy tend to be less active, but regular movement and enjoyable physical activities can improve health. Fun, practical activities are more likely to last and make a difference long term.

How can we make the most of the brain's neuroplasticity?

Neuroplasticity is the brain's ability to adapt and form new connections through activity and learning. It plays a key role in building brain connections and learning new skills.

Best strategies to support neuroplasticity

- Practice that matters: Regular, repeated, task-specific training works best—especially when the activity is meaningful to the person and practiced regularly in real-world environments. The brain learns and changes more when practicing a task that matters to the person, compared to practicing an isolated movement that is missing or atypical.
- Proven therapies: Therapies like Constraint-Induced Movement Therapy (CIMT) and virtual reality show promise for boosting brain changes in people with one-sided cerebral palsy, though more research is needed.

Key takeaway

Neuroplasticity is the brain's way of learning and adapting. Focused, meaningful practice helps make the most of this ability and supports better function over time.

Can the brain repair itself after injury?

The brain has some ability to repair itself using special stem cells found inside the brain. These cells may help with healing after an injury. Scientists are exploring how to prevent brain injuries, support the brain's natural healing, and use treatments like stem cell therapy to help with recovery.

What might help?

- Potential therapies: Growth factors, certain medications, cooling treatments (therapeutic hypothermia), and enriched environments may support recovery, but more research is needed.
- Future possibilities: Regenerative treatments like stem cell therapy show promise but need more study to make sure they are effective.

Key takeaway
Brain repair treatments may offer new hope for people with cerebral palsy. More research is needed to understand how to safely support brain healing after injury.

Do stem cells help treat cerebral palsy?

Stem cell therapies are being researched as potential treatments for cerebral palsy. Different types of cells are being explored, each working in different ways. These include umbilical cord blood, mesenchymal stromal cells (from cord blood, joints, or fat), and bone marrow-derived mononuclear cells, which aim to reduce inflammation and activate the brain's natural repair processes. Other cells, such as neural stem cells, aim to repair the brain by potentially replacing damaged cells, in addition to reducing inflammation and supporting natural repair processes.

What we know

- Umbilical cord blood is safe and has been shown to improve movement in young children with cerebral palsy who can walk or are likely to learn to walk (GMFCS levels I–III). It works best when given early (under age 5) and in higher doses.
- Other types of stem cells may also help with motor skills, independence, and overall function, with results still emerging.

Key challenges

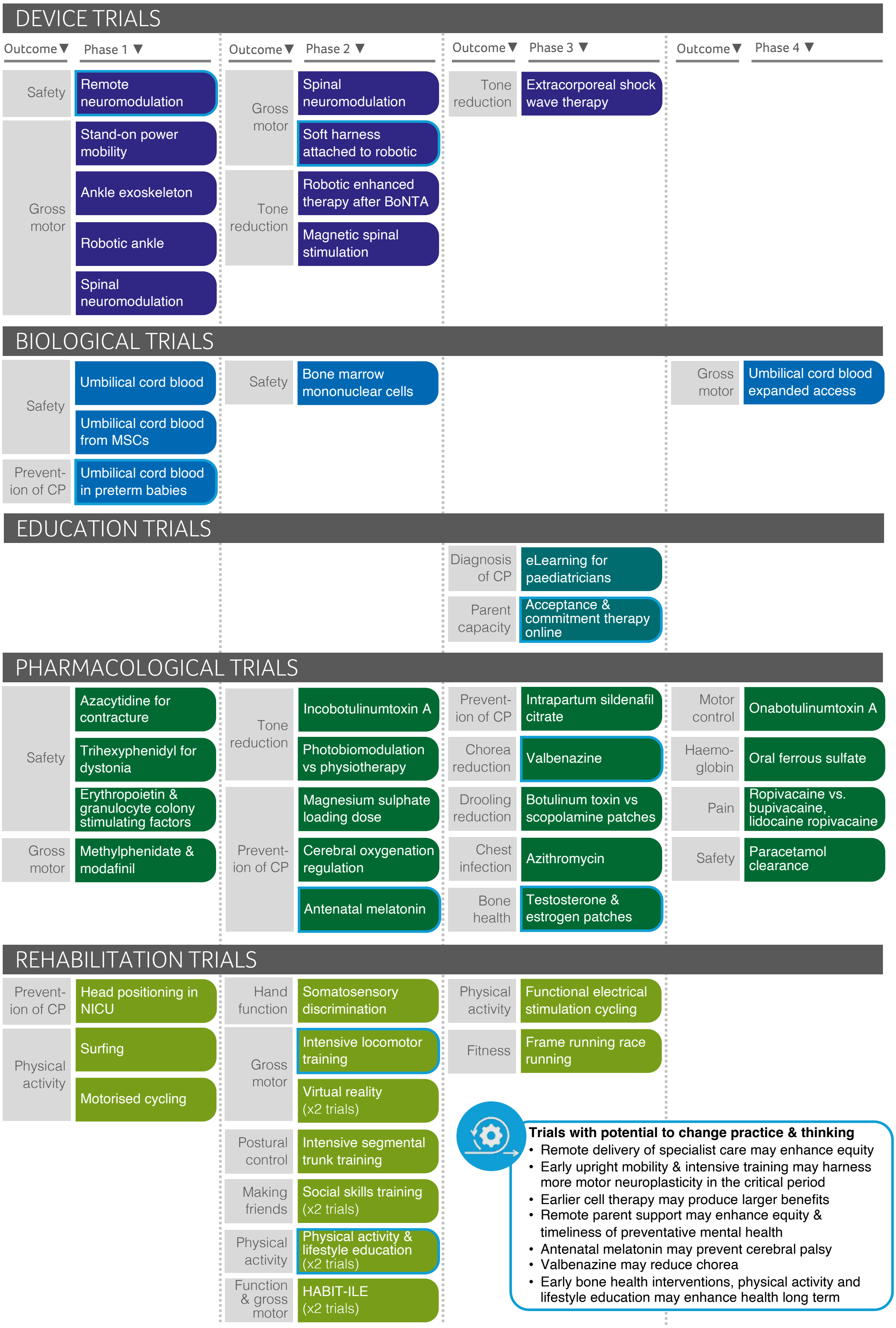
- Differences in the type of stem cells used, the dose, and how they're given make it hard to compare results across studies.
- More research is needed to understand how stem cells might support thinking, communication, and outcomes in older children, adults, and people with more complex physical needs.

Key takeaway
Umbilical cord blood is a safe and effective option for young children with cerebral palsy who can walk or are expected to learn to walk. Research continues into how other stem cell therapies could support people with cerebral palsy of all ages and abilities.

Current challenges and future directions

Dysphagia, pain, fatigue, and sleep remain under-researched in cerebral palsy. More studies are also needed in LMICs and on effective support for adults. A global cerebral palsy clinical trials network has been established to co-design studies with people with lived experience, focusing on the priorities that matter most to them. An overview of current clinical trials is shown in Figure 3.

Figure 3: Clinical Trials Underway



DEVICE TRIALS

Outcome ▼	Phase 1 ▼	Outcome ▼	Phase 2 ▼	Outcome ▼	Phase 3 ▼	Outcome ▼	Phase 4 ▼
Safety	Remote neuromodulation	Gross motor	Spinal neuromodulation	Tone reduction	Extracorporeal shock wave therapy		
Gross motor	Stand-on power mobility		Soft harness attached to robotic				
	Ankle exoskeleton	Tone reduction	Robotic enhanced therapy after BoNTA				
	Robotic ankle		Magnetic spinal stimulation				
	Spinal neuromodulation						

BIOLOGICAL TRIALS

Outcome ▼	Phase 1 ▼	Outcome ▼	Phase 2 ▼	Outcome ▼	Phase 3 ▼	Outcome ▼	Phase 4 ▼
Safety	Umbilical cord blood	Safety	Bone marrow mononuclear cells			Gross motor	Umbilical cord blood expanded access
	Umbilical cord blood from MSCs						
Prevention of CP	Umbilical cord blood in preterm babies						

EDUCATION TRIALS

Outcome ▼	Phase 1 ▼	Outcome ▼	Phase 2 ▼	Outcome ▼	Phase 3 ▼	Outcome ▼	Phase 4 ▼
				Diagnosis of CP	eLearning for paediatricians		
				Parent capacity	Acceptance & commitment therapy online		

PHARMACOLOGICAL TRIALS

Outcome ▼	Phase 1 ▼	Outcome ▼	Phase 2 ▼	Outcome ▼	Phase 3 ▼	Outcome ▼	Phase 4 ▼
Safety	Azacytidine for contracture	Tone reduction	Incobotulinumtoxin A	Prevention of CP	Intrapartum sildenafil citrate	Motor control	Onabotulinumtoxin A
	Trihexyphenidyl for dystonia		Photobiomodulation vs physiotherapy	Chorea reduction	Valbenazine	Haemoglobin	Oral ferrous sulfate
	Erythropoietin & granulocyte colony stimulating factors	Prevention of CP	Magnesium sulphate loading dose	Drooling reduction	Botulinum toxin vs scopolamine patches	Pain	Ropivacaine vs. bupivacaine, lidocaine ropivacaine
Gross motor	Methylphenidate & modafinil		Cerebral oxygenation regulation	Chest infection	Azithromycin	Safety	Paracetamol clearance
			Antenatal melatonin	Bone health	Testosterone & estrogen patches		

REHABILITATION TRIALS

Outcome ▼	Phase 1 ▼	Outcome ▼	Phase 2 ▼	Outcome ▼	Phase 3 ▼	Outcome ▼	Phase 4 ▼
Prevention of CP	Head positioning in NICU	Hand function	Somatosensory discrimination	Physical activity	Functional electrical stimulation cycling		
Physical activity	Surfing	Gross motor	Intensive locomotor training	Fitness	Frame running race running		
	Motorised cycling		Virtual reality (x2 trials)				
		Postural control	Intensive segmental trunk training				
		Making friends	Social skills training (x2 trials)				
		Physical activity	Physical activity & lifestyle education (x2 trials)				
		Function & gross motor	HABIT-ILE (x2 trials)				

Trials with potential to change practice & thinking
- Remote delivery of specialist care may enhance equity
- Early upright mobility & intensive training may harness more motor neuroplasticity in the critical period
- Earlier cell therapy may produce larger benefits
- Remote parent support may enhance equity & timeliness of preventative mental health
- Antenatal melatonin may prevent cerebral palsy
- Valbenazine may reduce chorea
- Early bone health interventions, physical activity and lifestyle education may enhance health long term

CONCLUSION

The global rate of cerebral palsy is decreasing due to progress in prevention, early diagnosis, and care. Early identification—as early as three months of age—and timely intervention are transforming outcomes by making the most of the brain’s natural ability to adapt and change.

However, cerebral palsy is a lifelong condition. As people age, they may face new challenges, such as declining mobility and more complex health needs. This highlights the importance of regular health monitoring and personalised support throughout life.

Over the past decade, there has been meaningful progress in improving quality of life for people with cerebral palsy. With continued innovation and a strong focus on meeting their changing needs, the future looks promising—offering hope and better opportunities for individuals with cerebral palsy and their families.