Acute and Chronic Neurological Diseases: Quick Notes

CYNTHIA B. HERNANDEZ, BSN,MSN/ED,RN,CRRN

Functional Health Patterns (53%): This domain involves applying the nursing process to optimize the restoration and preservation of the patient's health and holistic well-being across the lifespan. It also includes promoting optimal psychosocial patterns and coping and stress management skills of the patients and caregivers, optimizing the patient's functional ability, managing the patient's neurological and other complex medical conditions, promoting optimal nutrition and hydration, optimizing the patient's elimination patterns, and optimizing the patient's sleep and rest patterns.

Neurological Conditions

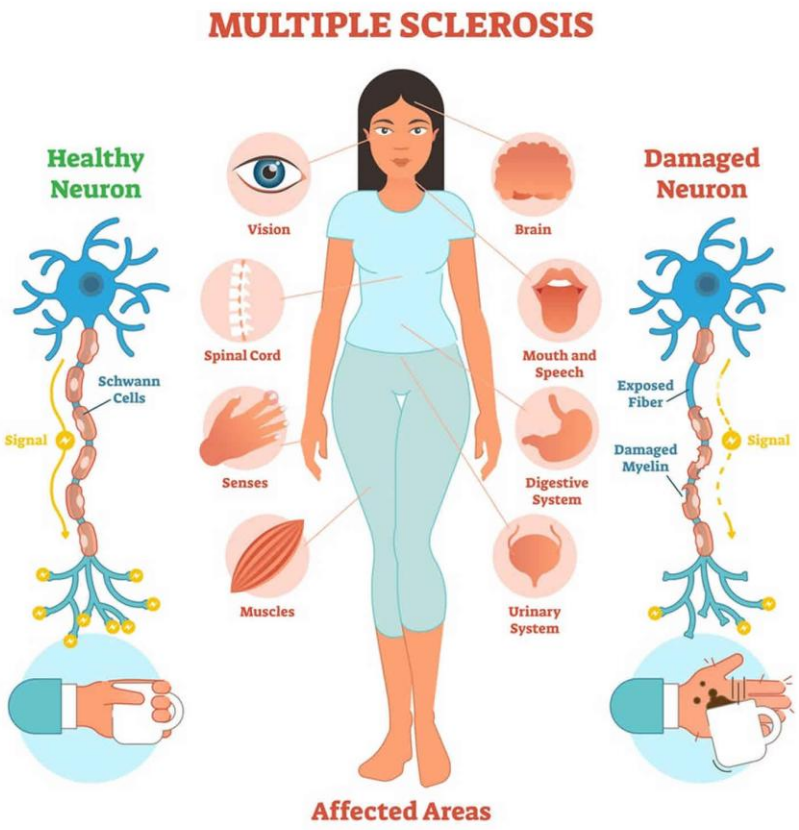
- Multiple Sclerosis
- Parkinson's Disease
- Guillain-Barré Syndrome
- Myasthenia Gravis
- Amyotrophic Lateral Sclerosis
- Postpolio Syndrome

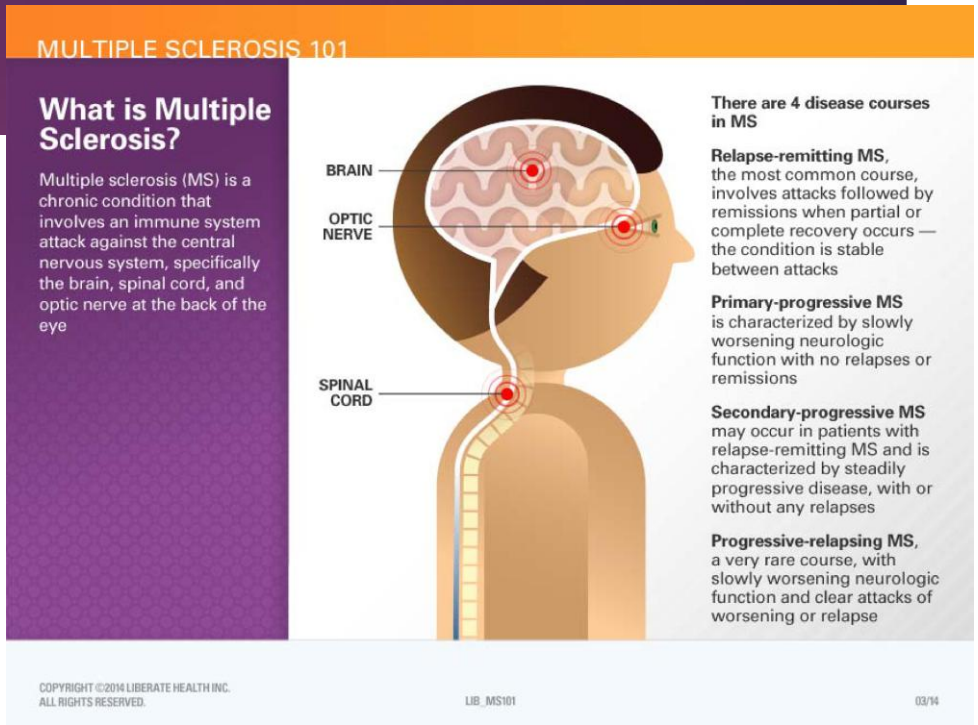
Objectives

Participants will be able to:

- Describe scope of each neurological disease/condition
- State Symptoms of each neurological disease/condition
- Identify the Goals of the Rehabilitation Nurse related the specific neurological disease/condition
- Describe the Nursing Interventions for each neurological condition

Multiple Sclerosis

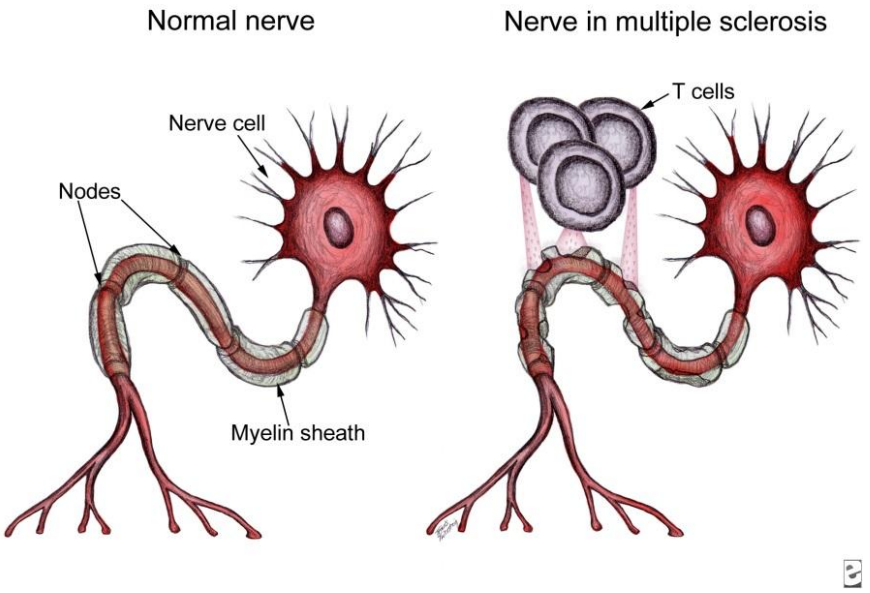




Management

- **Goal**

  To decrease the number and frequency of relapses, enhance recovery from exacerbations, alleviate symptoms, maintain independence and ensure the highest quality of life.

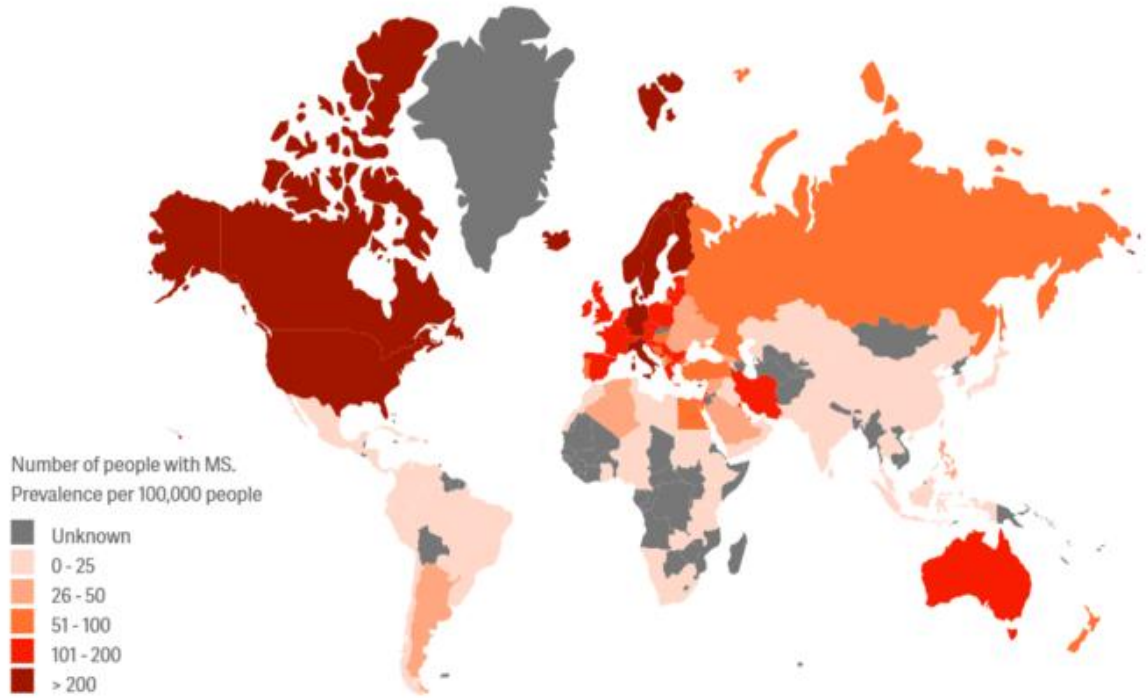


Epidemiology of MS

Category	Key Points
Global Prevalence	2.9 million people worldwide; higher rates in North America & Northern Europe
Incidence	~2.1 per 100,000/year globally; varies by region
Gender Distribution	2–3 times more common in women than men
Age of Onset	Most common between ages 20–40; pediatric and late-onset cases also occur

Epidemiology of MS

Category	Key Points
Ethnicity & Race	More common in Caucasians; increasing recognition in Black, Hispanic, and Asian populations
Geographic Patterns	Higher prevalence in temperate climates; lower near the equator
Trends	Rising incidence possibly due to better diagnostics and awareness



- Average age of onset- 30, most diagnosis between 15-50
- Onset after 40, more likely is Primary Progressive

Epidemiology

- Major cause of disability and economic hardship in young adults 20-50 years of age.
- Incidence
  - The average person in the United States has about one in 750 (.1%) chance of developing MS.
  - The data shows that the number of people with MS across the globe has increased from 2.3 million in 2013 to 2.8 million in 2020 and 2.9 in 2023.
  - Approximately 200 people are diagnosed weekly
- There are at least twice as many females (69%) with MS as there are males (31%).
- MS occurs in most ethnic groups
  - more common in Caucasians of N. European ancestry.

Common Symptoms:
🧠 Multiple Sclerosis (MS)

- Fatigue
- Visual disturbances (optic neuritis, blurred vision)
- Muscle weakness or spasticity
- Numbness or tingling
- Balance and coordination problems
- Bladder and bowel dysfunction
- Cognitive impairment
- Heat sensitivity

🩺 Rehabilitation Nursing Focus:

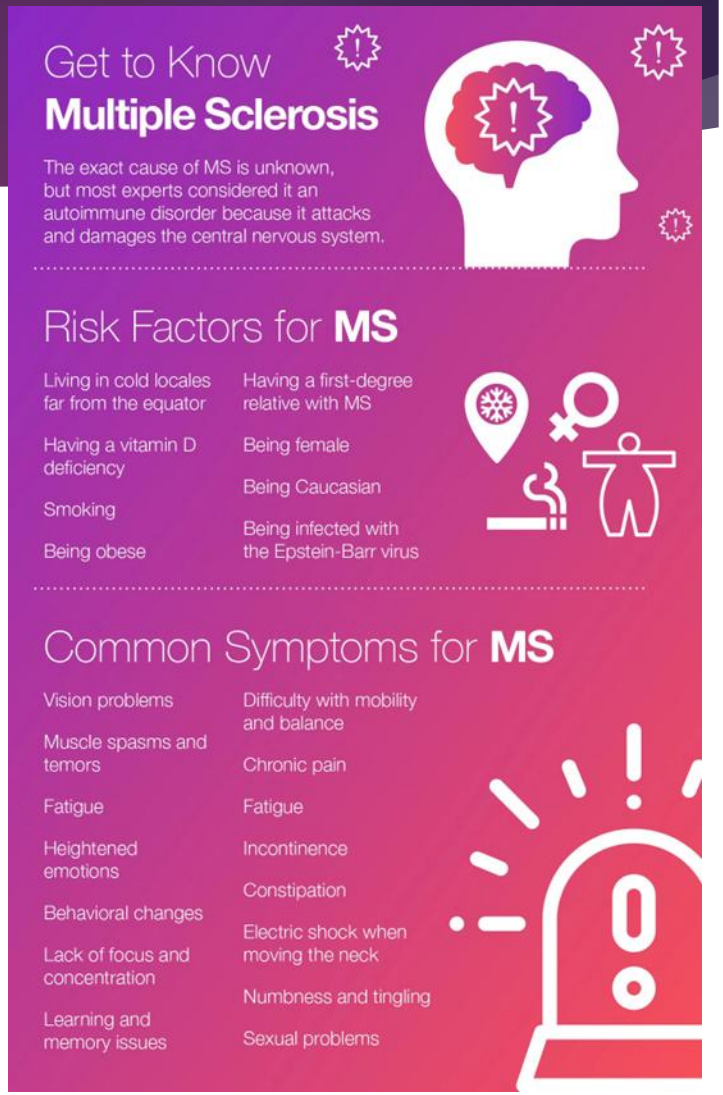
- **Energy conservation**: Avoiding overuse of weakened muscles.
- **Mobility aids**: Bracing, orthotics, wheelchairs as needed.
- **Pain management**: Physical therapy, heat, medications.
- **Exercise guidance**: Low-impact, non-fatiguing routines.
- **Support groups**: For emotional and peer support.

Rehabilitation & Supportive Care

- **Physical therapy**: Mobility, balance, strength
- **Occupational therapy**: ADLs, energy conservation
- **Speech therapy**: Dysarthria, dysphagia
- **Mental health**: Counseling, mindfulness, antidepressants
- **Lifestyle**: Vitamin D, smoking cessation, exercise

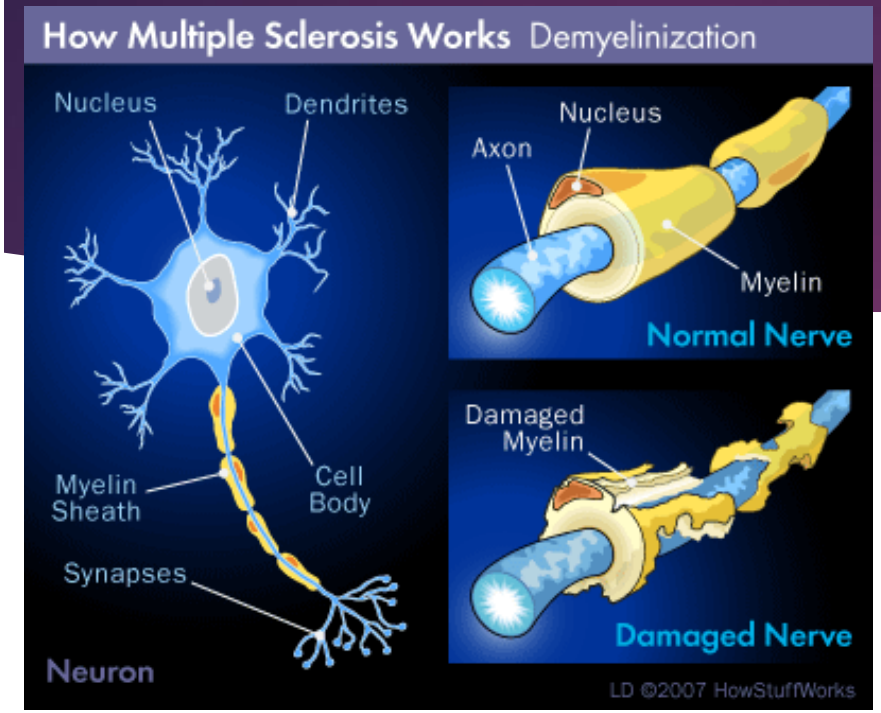
Multiple Sclerosis

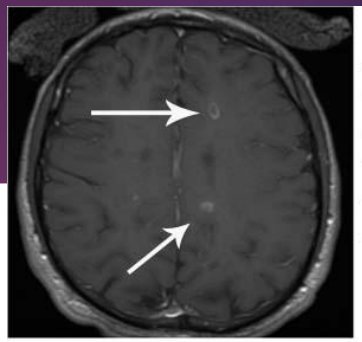
One of the most positive trends in MS epidemiology [study of the disease among a population] is the declining mortality [number of deaths] and slowing disability progression, attributable to advances in medical care.



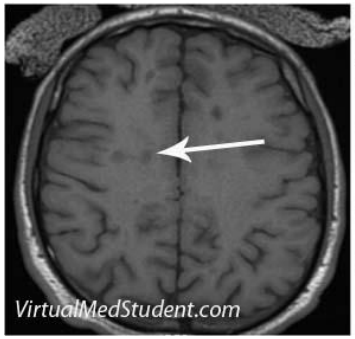
Multiple Sclerosis Resource: Worldwide

- https://www.msif.org/wp-content/uploads/2021/05/Atlas-3rd-Edition-clinical-management-report-EN-5-5-21.pdf





Axial T1 MRI with contrast (ie: gadolinium) - notice enhancing lesions are seen indicating active demyelination is occuring



Axial T1 MRI without contrast - old lesions can be seen consistent with previous demyelination and gliosis.

Normally the blood brain barrier protects the brain from immune-cell attack. In MS, activated T Cells migrate into the CNS- starting an antibody-antigen response leading to inflammation. The myelin is attacked, oligodendrocytes disappear and astrocytes remove damaged myelin forming scar tissue.

Multiple Sclerosis

- Unpredictable disease that results in diverse neurologic impairments, requires a collaborative approach to care
- Associated with Signs and Symptoms caused by the loss of myelin sheath integrity that interferes with the efficiency of nerve impulse conduction in the CNS

Clinically Isolated Syndrome (CIS)

- In 1996 the United States National Multiple Sclerosis Society standardized the following four subtype definitions:
  - Relapsing-remitting-
  - Secondary progressive
  - Primary progressive
  - Progressive relapsing
  - Clinically-isolated syndrome (2001)

Clinically isolated syndrome (CIS)

- First episode of neurologic symptoms that lasts at least 24 hours and is caused by inflammation or demyelination in the central nervous system. The episode usually has no associated fever or infection and is followed by a complete or partial recovery.

Clinically Isolated Syndrome (CIS)

CIS can be either monofocal or multifocal:

- **Monofocal episode**: The person experiences a single neurologic sign or symptom — for example, an attack of optic neuritis — that's caused by a single lesion.
- **Multifocal episode**: The person experiences more than one sign or symptom — for example, an attack of optic neuritis accompanied by numbness or tingling in the legs — caused by lesions in more than one place.

Clinically Isolated syndrome (CIS)

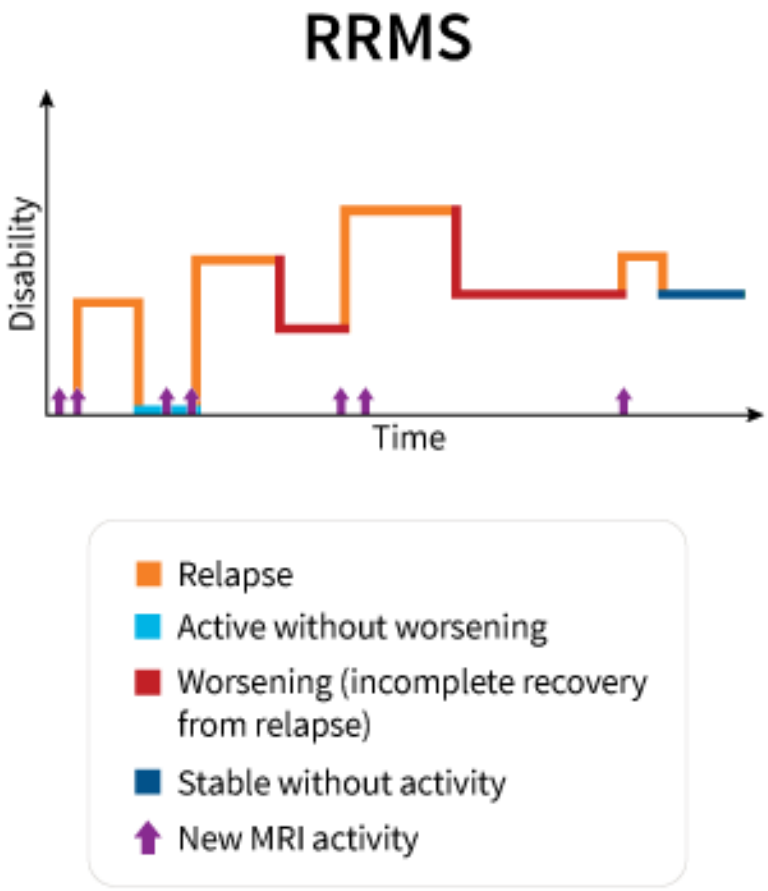
- **If MRI-detected brain lesions similar to those in MS are present then the risk of developing MS is High:** *the person has a 60 to 80 percent chance of a second neurologic event and diagnosis of MS within several years.*

- **If there is no MRI-detected brain lesions then the risk of developing MS is Low** : *the person has about a 20 percent chance of developing MS.*

Studies have shown that early treatment with disease-modifying medications may decrease the risk, or delay the occurrence, of a second exacerbation.

Results from these studies have led to FDA approval of several disease-modifying treatments to be used by people diagnosed with CIS.

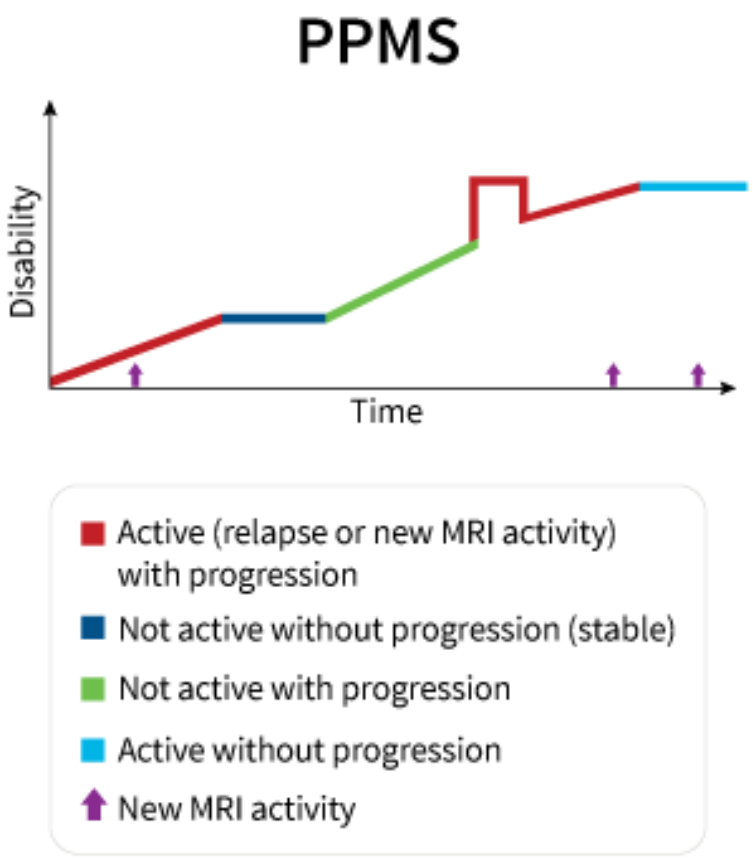
Relapsing-remitting MS (RRMS).



Source: Lublin et al., 2014.

The most common MS course, RRMS may now also be described either as active—meaning the individual is experiencing a relapse and/or new MRI activity—or as not active, meaning that no disease activity is occurring. However, RRMS characterized as "not active" may still be worsening, if there is a confirmed increase in disability due to symptoms persisting after a relapse. Conversely, doctors may characterize a person's RRMS as active but not worsening if they see new MRI activity, but no increase in clinical symptoms.

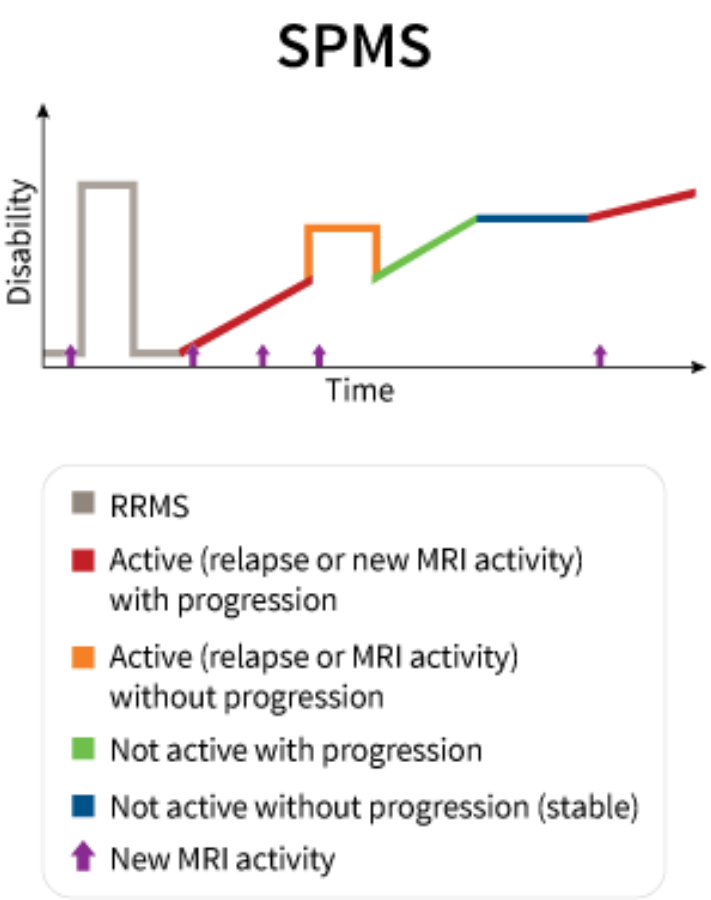
Primary progressive MS (PPMS).



Source: Lublin et al., 2014.

PPMS is characterized by steadily worsening neurologic function or disability from the onset of symptoms. A diagnosis of PPMS may be further modified at any point in time as active, with new MRI activity and/or relapses, or as not active. In addition, both active and not active PPMS may be further modified as with progression, meaning there is objective evidence of sustained worsening over time, or without progression. Active PPMS may still be described as "without progression" if there are new lesions on MRI, but no observable increase in disability

Secondary progressive MS (SPMS)



Source: Lublin et al., 2014.

Like PPMS, SPMS is characterized by a progressive worsening of neurologic function; however, unlike PPMS, SPMS follows an initial relapsing-remitting course. It can be characterized at different points in time as active or not active, as well as with progression or without progression. As with active PPMS, people with active SPMS should discuss treatment with a DMT with their healthcare providers.

Management of MS uses a comprehensive, interdisciplinary approach that encompasses:

- relapse management
- disease modification
- symptom management
- rehabilitation
- psychosocial support
- wellness

Clinical Manifestations

- **Primary Symptoms**
  - Occur as result of nerve conduction deficits
  - Reflect a specific area of dysfunction in the CNS
  - Range from mild to severe, unpredictable, vary from person to person, and time to time in the same person

Primary Signs & Symptoms

- Paresis/paralysis
- Spasticity
- Hyperreflexia
- Vertigo
- Nystagmus
- Dysarthria
- Seizures
- Heat intolerance
- Dysphagia
- Cognitive deficits
- Bladder dysfunction
- Mild to disabling fatigue
- Vision loss, diplopia
- Sensory loss, paresthesia
- Balance disturbances, ataxia
- Numbness, tingling, pain and tremors
- Euphoria, depression
- Hearing deficits, tinnitus

Clinical Manifestations

- **Secondary Symptoms**
  - Occur as a consequence of primary symptoms
  - Include problematic complications resulting from decreased neurologic function

Secondary Signs and Symptoms

- Injuries
  - Falls, skin breakdown, contractures, fractures
- Self Care Deficits
- Decreased Safety due to visual deficits
- Interruption in rest, disturbed sleep
- Decline in libido and orgasmic ability
- Urinary tract infections
- Bowel and bladder incontinence or retention
- Gait pattern deficits, communication deficits, swallowing deficits
- Marked decline in healthy and effective coping strategies

Primary Signs & Symptoms

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- Communication deficits
- Marked decline in healthy and effective coping strategies

Clinical Manifestations

- **Tertiary Symptoms**
  - Evolve as cumulative and detrimental effects of the disease affect all aspects of the person's life

  Include:

  - Psychosocial
  - Vocational
  - Financial
  - Emotional problems

Consider Sexuality

Tertiary Signs and Symptoms

- Loss of job
- Change in Roles
- Social Isolation
- Divorce
- Ineffective coping with anxiety, denial, anger, reactive depression, and suicide
- Loss of financial stability, self-esteem, and self-worth

Pathophysiology of Multiple Sclerosis

- **1. Autoimmune Activation**
  T cells cross the **blood-brain barrier (BBB)** and initiate an immune response.
  B cells and macrophages contribute to inflammation.
- **2. Demyelination**
  Immune cells attack **myelin sheaths** surrounding CNS axons.
  Leads to **slowed or blocked nerve conduction**.
- **3. Axonal Damage**
  Chronic inflammation causes **irreversible axonalinjury** and **neurodegeneration**.
  Contributes to long-term disability.
- **4. Gliosis**
  Damaged areas are replaced by **glial scars** (sclerosis).
  Seen as **lesions on MRI**.

5. Disease Progression

Begins with **relapsing-remitting** episodes.
May evolve into **secondary progressive MS** with steady decline.

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Diagnostic Criteria for MS (2021 McDonald Criteria)

✅ **1. Clinical Presentation**

- At least **1 clinical attack** (relapse) involving CNS demyelination (e.g., optic neuritis, brainstem syndrome, spinal cord symptoms).

🧭 **2. Dissemination in Space (DIS)**

- Evidence of lesions in **at least 2 of 4 CNS regions**:
- Periventricular
- Juxtacortical or cortical
- Infratentorial
- Spinal cord

Can be demonstrated by MRI or clinical symptoms.

Diagnostic Criteria for MS (2021 McDonald Criteria)

⏳ 3. Dissemination in Time (DIT)

- Simultaneous presence of **enhancing and non-enhancing lesions** on MRI **OR**
- A **new lesion** on follow-up MRI **OR**
- A **second clinical attack** affecting a different CNS site

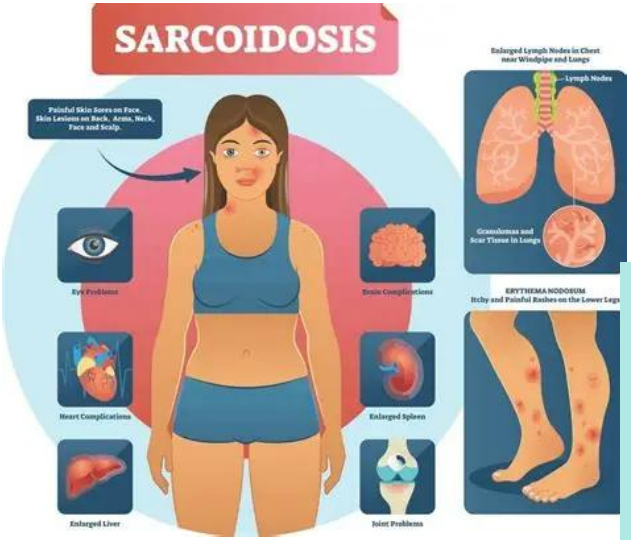
🧪 4. CSF Findings (Optional but Supportive)

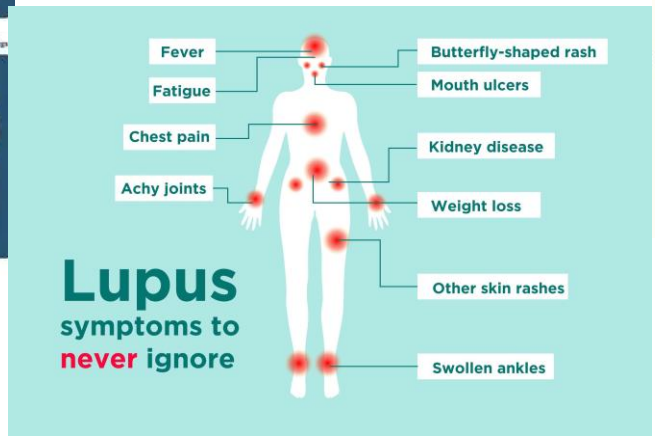
- Presence of **oligoclonal bands (OCBs)** in cerebrospinal fluid (CSF) can substitute for DIT in some cases.

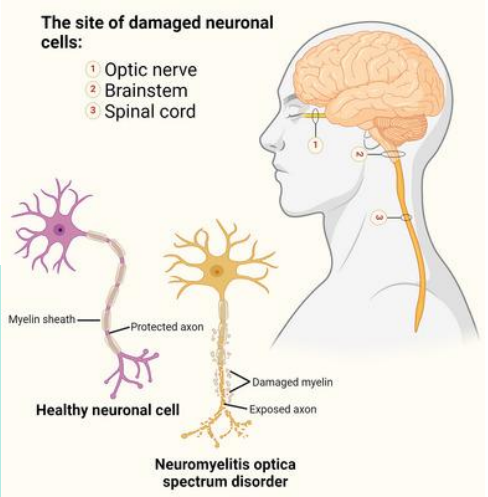
Diagnostic Criteria for MS (2021 McDonald Criteria)

❗ 5. Rule Out Other Diagnoses

- Exclude mimics such as neuromyelitis optica spectrum disorder (NMOSD), lupus, sarcoidosis, or infections.







Management/ Treatment of MS (2025)

🧠 1. Disease-Modifying Therapies

💉 Injectable Therapies

- **Interferons, Glatiramer acetate**
- Long safety record, but frequent dosing

💊 Oral Therapies

- **Fingolimod, Dimethyl fumarate, Teriflunomide, Siponimod, Ozanimod, Ponesimod**
- Convenient, but monitor for infections and liver function

💧 Infusion Therapies

- **Natalizumab, Ocrelizumab, Alemtuzumab, Ofatumumab, Ublituximab**
- High efficacy, less frequent dosing, immunosuppression risks

🔬 Emerging Therapies

- **BTK inhibitors** (e.g., tolebrutinib, evobrutinib)
- Biomarker-guided treatment (e.g., NfL levels)

📌 Trends in 2025

- Early high-efficacy treatment favored
- Personalized plans based on disease activity
- Shared decision-making emphasized

Management/ Treatment of MS (2025)

🩺 2. Symptomatic Management

- **Spasticity**: Baclofen, tizanidine, physical therapy
- **Fatigue**: Amantadine, modafinil, energy conservation
- **Pain**: Gabapentin, pregabalin, antidepressants
- **Bladder/Bowel Dysfunction**: Anticholinergics, pelvic floor therapy
- **Cognitive Issues**: Cognitive rehab, stimulants

🧘 3. Rehabilitation & Supportive Care

- **Physical therapy, occupational therapy, speech therapy**
- **Mental health support: Counseling, mindfulness, antidepressants**
- **Lifestyle: Vitamin D, smoking cessation, exercise, diet**

🧬 4. Personalized & Preventive Approaches

- **Biomarker-guided therapy (e.g., neurofilament light chain)**
- **Early high-efficacy treatment to prevent long-term disability**
- **De-escalation strategies for stable patients**

Diagnosis

Tests and procedures used to diagnosis MS

Magnetic resonance imaging, or MRI for short, is a type of scan that uses strong magnetic fields and radio waves to produce detailed images of the inside of the body. Importantly, MRI scans can show there is damage to the central nervous system before the person experiences symptoms of MS.

Lumbar punctures, which allow a sample of spinal fluid to be tested for immune cells and antibodies.

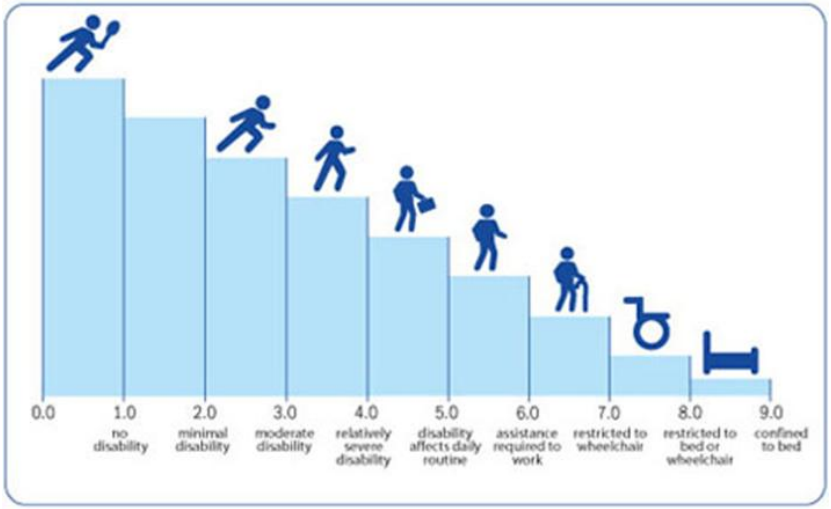
Evoked potentials, which measure the time it takes for the brain to receive messages from the eyes, ears and skin.

OCT (optical coherence tomography), which scans nerves in the back of the eye to detect signs of optic neuritis, a common early symptom of MS.

Tools/ Scales to measure function/ progression

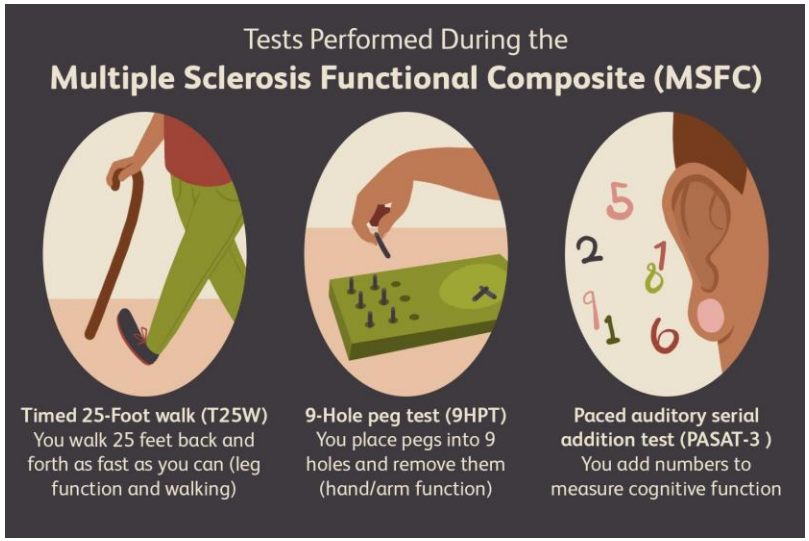
Kurtzke ***Expanded Disability Status Scale (EDSS)***. measures degree of disability, largely in terms of mobility. It uses whole & half numbers from one to 10 to measure degree of disability, largely in terms of mobility.

The EDSS is used in conjunction with Kurtzke's ***Functional System (FS)***. This measures the function of seven major systems in the CNS (plus a section for ''other''), each relating to the different areas of functioning that can be affected by MS (such as movement, sensory, bowel and bladder, vision, cognition, etc.). These are each graded on a scale of zero (normal) to six (severe).



Tools/ Scales to measure function/ progression

A newer measurement system designed to be even more sensitive is the ***MS Functional Composite (MSFC)*** scale. This measures lower extremity function with a ***Timed 25-Foot Walk***, upper extremity function through the ***9-Hole Peg Test (9-HPT)***, and cognitive function, using the ***Paced Auditory Serial Additions Test (PASAT)***.



Common DMTs

- **Oral Medications**
- Learn about the following oral medications that are FDA-approved for treating MS:
- Aubagio®
- Bafiertam®
- Dimethyl Fumarate
- Gilenya®
- Mavenclad®
- Mayzent®
- Ponvory®
- Tascenso ODT®
- Tecfidera®
- Vumerity®
- Zeposia®

Intravenous Infusion Treatments

Learn about the following intravenous infusion DMTs that are FDA-approved for treating MS:

Briumvi®

- Ocrevus®
- Lemtrada®
- Novantrone®
- Tyruko®
- Tysabri®

Common DMTs

- **Injection Treatments**
- Learn about the following injectable DMTs that are FDA-approved for treating MS:
- Avonex®
- Betaseron®
- Copaxone®
- Extavia®
- Glatiramer Acetate Injection
- Glatopa®
- Kesimpta®
- Ocrevus Zunovo™
- Plegridy®
- Rebif®

https://www.nationalmssociety.org/managing-ms/treating-ms/disease-modifying-therapies

FDA-Approved Medications and Devices To Treat MS Symptoms

https://www.nationalmssociety.org/managing-ms/treating-ms/treatments-and-medications

Ampyra® Medication Walking Difficulties	**Baclofen** Medication Spasticity	**BOTOX®** Medication Bladder Dysfunction
BOTOX® Medication Spasticity	**Dantrolene** Medication Spasticity	**Myrbetriq®** Medication Bladder Dysfunction
Nuedexta® Medication Pseudobulbar Effect	**Oxybutynin** Medication Bladder Dysfunction	**PoNS® Device** Medical Device Walking Difficulties

DMT & other Medications

- Infused DMTs include:
  - Alemtuzumab (Lemtrada®)
  - Mitoxantrone (Novantrone®)
  - Natalizumab (Tysabri®)
  - Natalizumab-sztn (Tyruko®)
  - Ocrelizumab (Ocrevus®)
  - Ublituximab-xiiy (Briumvi™)
- Medications used Off-Label
  - Mycophenolate Mofetil
  - Cyclophosphamide
  - Azathioprine
  - Minocycline
  - Rituximab
  - Statins

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PML

- Progressive multifocal leukoencephalopathy (PML) is a rare, progressive white matter brain disease that targets cells that make myelin and usually leads to severe disability or death. PML is caused by the reactivation of the JC (John Cunningham) virus, a common virus to which most people have been exposed.
- One medication, Tysabri, tests for JC virus before starting treatment and while on treatment to help identify people who are at a higher risk for PML.
- Symptoms of PML are diverse and can be similar to MS symptoms, including clumsiness, weakness and visual, speech and personality changes. Individuals should be alert to any new or worsening symptoms and report them promptly to their MS healthcare provider.

- Currently, the best available therapy is reversal of the immune-deficient state, since there are no effective drugs that block virus infection without toxicity.

- In general, PML has a mortality rate of 30-50 percent in the first few months following diagnosis but depends on the severity of the underlying disease and treatment received. Those who survive PML can be left with severe neurological disabilities.

Managing relapses

- For severe relapses (involving loss of vision, severe weakness or poor balance, for example), which interfere with a person's mobility, safety or overall ability to function, most neurologists recommend treatment with corticosteroids.
- Corticosteroids are not believed to have any long-term benefit on the disease.
- Plasmapheresis (plasma exchange) may be considered for severe exacerbations that do not respond adequately to the standard steroid treatment.
- **Rehabilitation**

Medication options include

- High-dose Intravenous Solu-Medrol® (methylprednisolone)
- High-dose Oral Deltasone® (prednisone)
- H.P. Acthar Gel (ACTH) is an option for those who are unable to cope with the side effects of high-dose corticosteroids, have been treated unsuccessfully with corticosteroids, do not have access to intravenous therapy, or have trouble receiving medication intravenously because of difficulty accessing the veins.

Rehabilitation

- **The goal of a rehabilitation program is to restore or maintain functions essential to daily living.** Rehabilitation can be especially useful soon after an exacerbation
- The members of the rehab team —
  - Physical therapists
  - Occupational therapists
  - Speech/language pathologists
  - Cognitive remediation specialists

Rehabilitation

The team address problems with:

- Mobility,
- ADLs,
- Role performance at home and work
- Overall fitness

They also provide evaluation and treatment of speech and swallowing difficulties and problems with thinking and memory that may have appeared or worsened during the exacerbation.