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### Magnetic Resonance Imaging of Multiple Sclerosis

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#### Recommended Citation

Finlay, Olivia, "Magnetic Resonance Imaging of Multiple Sclerosis" (2026). *Student Research Poster Presentations 2026*. 2.

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## Introduction

Magnetic resonance imaging (MRI) is a key tool in the diagnosis and monitoring of multiple sclerosis (MS). MRI allows doctors to see lesions in the brain and spinal cord and track disease activity over time. MS is an autoimmune neuroinflammatory disorder affecting the central nervous system. MS affects an estimated 900,000 people in the United States. MS most often develops in young adults, typically between the ages of 20 and 30. MS can lead to physical disability, cognitive difficulties, and a reduced quality of life. Globally, studies show that the incidence and burden of MS have increased over the past decades. This highlights the importance of early diagnosis and effective monitoring for patient outcomes. MS is treated with medication to slow the progression of the disease, steroids for flare-ups, treatment to manage symptoms, therapy to help with movement and daily activities, and healthy lifestyle support. Although MRI is effective for monitoring and detecting MS plaques, ongoing research suggests that future advancements in MRI techniques and biomarkers may improve early diagnosis and help predict disease progression more accurately.

## Magnetic Resonance Imaging

A noninvasive imaging technique that creates images using strong magnetic fields and radiofrequency energy (Rollins et al., 2023)

MRI sequences for MS

- T1-Weighted: shows significant lesion and patient disability
- T2-Weighted: shows new or growing lesions
- Fluid Attenuated Inversion Recovery (FLAIR): shows lesions by brain matter and by fluid-filled spaces
- T1-Weighted with contrast: shows inflamed spots (Elahi et al., 2025)

## Symptoms of Multiple Sclerosis (MS)

- Blurry vision
- Impaired eye movement
- Hearing loss
- Muscle weakness
- Numbness or tingling in limbs
- Issues with balance and coordination
- Fatigue
- Cognitive issues
- Urinary & Bowel dysfunction
- Speech issues

(McGinley et al., 2021)

## Multiple Sclerosis (MS)

MS is an autoimmune disorder affecting the brain and spinal cord (McGinley et al., 2021.)

Types of MS:

- Relapsing-Remitting MS (RRMS): flare-ups followed by partial or complete recovery (McGinley et al., 2021)
- Secondary Progressive MS (SPMS): starts as RRMS, neurologic function declines (McGinley et al., 2021)
- Primary Progressive MS (PPMS): symptoms get worse from the beginning (McGinley et al., 2021)
- Clinically Isolated Syndrome (CIS): first episode of symptoms (Filippi et al., 2023)

## Incidence Rate

- Increased globally over time
- Most common in ages 20-35
- Females are more affected than males

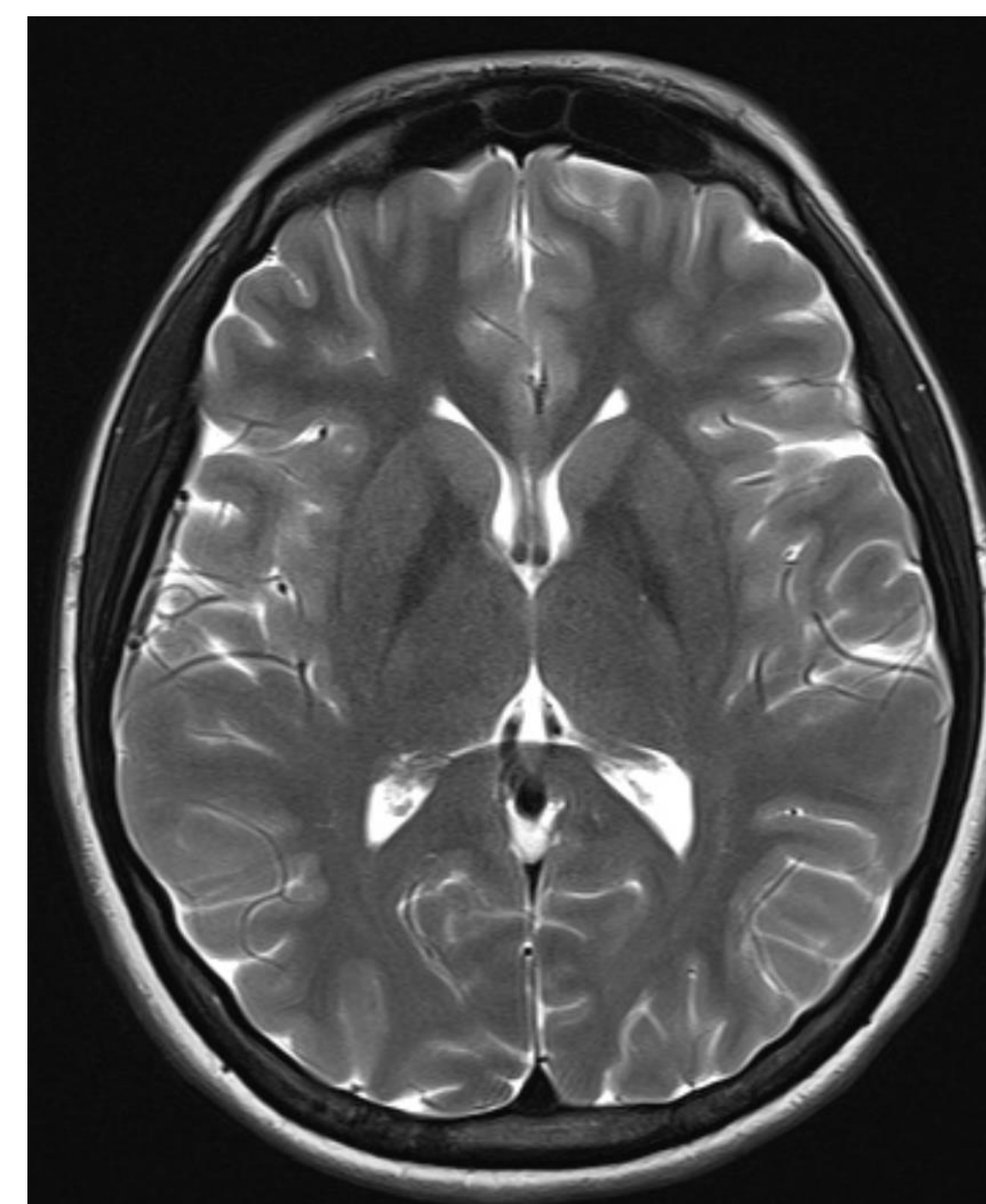
(Wang et al., 2025)

## Mortality Rate

- Decreased globally over time
- Highest in ages 50-54
- Higher in females than in males

(Wang et al., 2025)

**Normal**  
(no lesions)



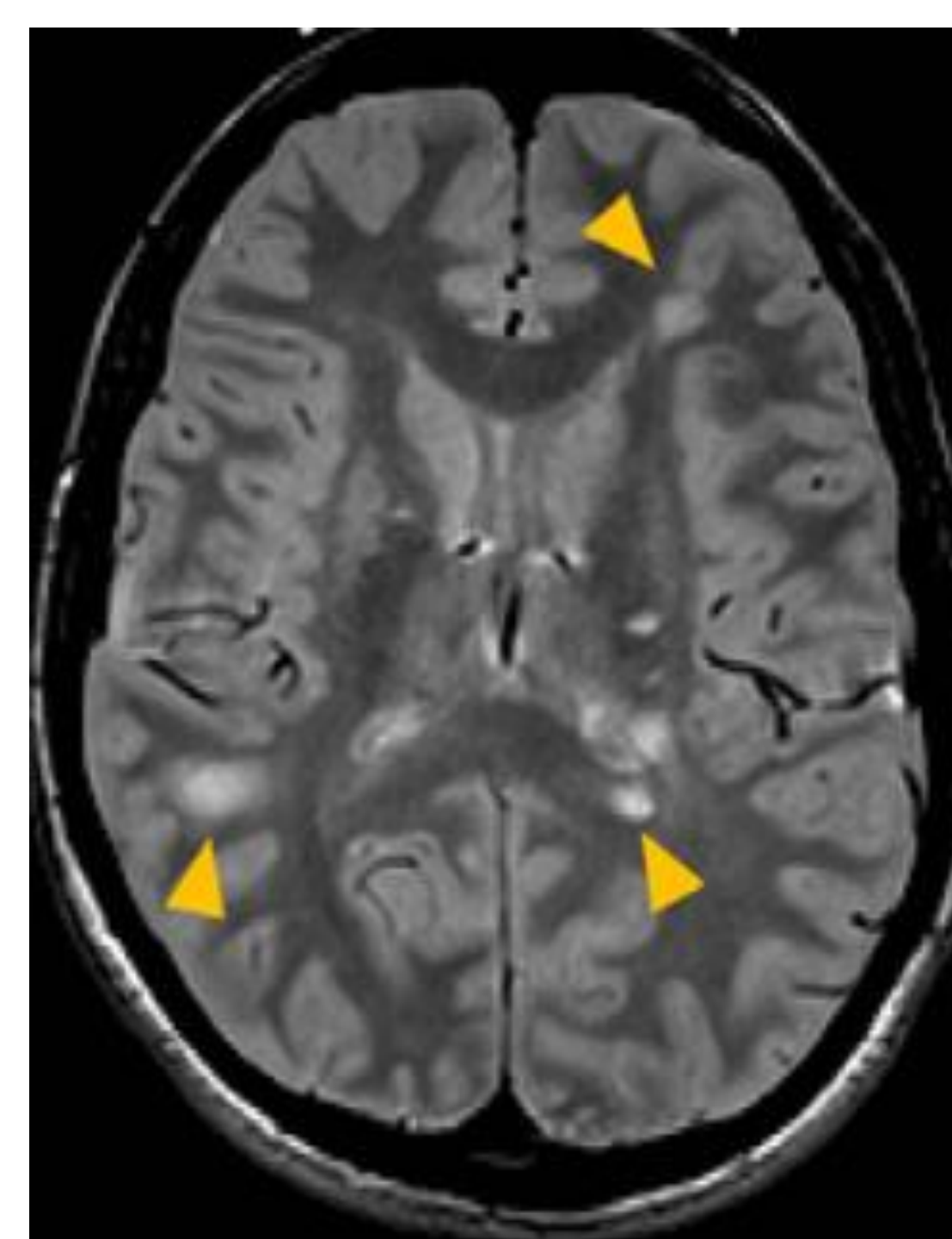
(Abidin, 2022, Axial T2)

**Normal**  
(no lesions)



(Smith, 2022, Sagittal T2)

**Brain Lesions**  
(orange arrows)



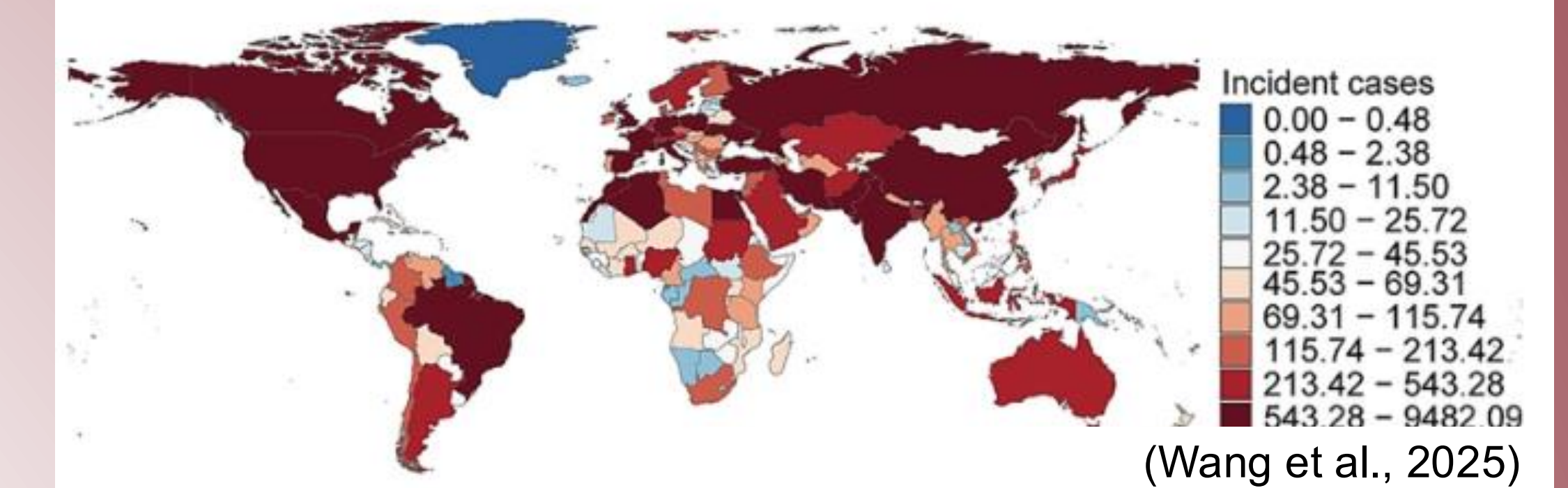
(Rocca et al., 2024, p. 10)

**Spinal Cord Lesions**  
(orange arrows)



(Rocca et al., 2024, p. 10)

## Number of Incident Cases



## Treatment

- Medications
    - Slow the progression, reduce relapses, and reduce new lesion formations
    - Manage symptoms caused by plaques
  - Health care providers
    - Neurologists for treatment
    - Physical therapists to help with movement and strength
    - Occupational therapists to help with daily activities
- (McGinley et al., 2021)

## Prognosis

- There is no cure
- Course of disease is unpredictable as
  - some patients have long stable periods others progress faster (McGinley et al., 2021)
- Early diagnosis and treatment reduces relapses and slows disability (Filippi et al., 2023)
- Life expectancy is slightly lower than the general population
  - 75.9 vs. 83.4 years (McGinley et al., 2021)
- Routine MRI scans help track new or enlarging lesions (Elahi et al., 2025)

## Conclusion

Magnetic resonance imaging (MRI) is essential for diagnosing and monitoring multiple sclerosis (MS) because it allows doctors to visualize brain and spinal cord lesions and track disease activity. MS is an autoimmune disorder that can cause cognitive issues and reduced quality of life. While there is no cure, medications, therapy, and lifestyle support can slow progression and improve outcomes. Future advancements in MRI technology include artificial intelligence and automated quantification tools that count and measure lesions. These tools may make it easier for doctors to detect MS earlier and predict disease progression (Rocca et al., 2024).