A new MS diagnosis can be scary and overwhelming. For some, it’s a relief to finally understand the reason for puzzling symptoms that may have been an issue for quite some time. For others, MS manifests itself suddenly and the diagnosis comes as a shock. For most, the disease adds an element of uncertainty to the future. It’s easy to feel isolated and lonely while facing an MS diagnosis, even with a loving family and supportive friends. These loved ones may not fully understand what living with MS is really like. There are a variety of strategies one can try to weather the storm. In addition, a number of MS organizations offer a wide array of resources and support to help those newly diagnosed with the disease better understand its scope and rise to meet its day-to-day challenges.

Our first article contains a wealth of information to help those newly diagnosed with MS learn about and adjust to their “new normal.”

MS is a progressive, autoimmune disorder where the system designed to keep the body healthy (the immune system) mistakenly attacks the nerves in the brain and spinal cord. The protective covering of nerve cells (myelin sheath) is damaged, which interferes with the conduction of signals. This nerve damage can cause a myriad of symptoms that can be variable and unpredictable, depending on the location and extent of nerve damage. Because MS affects every individual differently, it can be very difficult to diagnose. Learn more about the variety of symptoms MS can cause, and how the disease is diagnosed.
In our third article, MS epidemiologist at Case Western Reserve University, Farren Briggs, explores the factors contributing to the presentation of MS. For example, is the beginning of the disease defined by disease activity? Is disease activity measured by number of relapses, or the time between relapses? Dr. Briggs also delves into other interesting topics, like the rate of disability, as well as the diversity and patterns of symptoms in early MS.

Coping with MS isn’t easy at times, however successful treatment of MS and its symptoms can make a big difference in living with the disease. Effective MS treatments vary from person to person, what works well for one person won’t necessarily work for another. It’s important for people with MS to work with their healthcare providers to develop a treatment plan that addresses their physical symptoms and emotional outlook. This should be an ongoing dialogue throughout the disease course, as symptoms evolve. Read more about the wide variety of MS treatment options, including some alternative treatments some find helpful.

Are you interested in opportunities to participate in research, or MS events that may be occurring in your area? Check out our new Research Spotlight! This month we feature a number of exciting research opportunities for people with MS, including Healthy Mind, Healthy You, a study of mindfulness; REAL MS, a longitudinal study of MS; and, MS studies currently looking for new participants at the Ohio State University and UMass Medical School. Also featured are a patient symposium hosted by the Tisch MS Research Center of New York and a Multiple Sclerosis Summit hosted by the MS Coalition.

Newly Diagnosed With MS?

A new MS diagnosis can be scary and overwhelming. For some, it’s a relief to finally understand the reason for puzzling symptoms that may have been an issue for quite some time. For others, MS manifests itself suddenly and the diagnosis comes as a shock. For most, the disease adds an element of uncertainty to the future. It’s easy to feel isolated and lonely while facing an MS diagnosis, even with a loving family and supportive friends. These loved ones may not fully understand what living with MS is really like. There are a variety of strategies one
can try to weather the storm. In addition, a number of MS organizations offer a wide array of resources and support to help those newly diagnosed with the disease better understand its scope and rise to meet its day-to-day challenges.

When faced with an MS diagnosis, there are a number of things one can do to help cope with this new knowledge and manage the disease. It’s important to consider who to share this information with. One should not feel obligated to tell everyone. Announcing the news to an employer could have negative implications. People newly diagnosed with MS should pick the people who will be most supportive and helpful as they learn to live with the disease. There are many myths and misconceptions about MS. Many people find it helpful to learn as much as possible about the disease. Knowing the facts may help make an MS diagnosis less scary. It helps to understand that MS symptoms are unpredictable. No two people have exactly the same symptoms, and one may have different symptoms from time to time. Over the course of the disease, some may come and go, while others may be long lasting. Keeping a record of MS symptoms is another useful practice. This not only helps physicians determine how the disease is progressing and if prescribed treatments are working. It also helps them recognize MS relapses. Certain triggers, such as stress, lack of sleep, infection and overheating, are thought to bring on MS relapses, or make them worse. It’s important for people with MS to avoid these triggers.

MS is a lifelong disease, so it’s essential for people living with the disease to find the right doctor (one they are comfortable working with). Research shows the disease is more likely to progress and possibly lead to disability if treatment isn’t started early in the disease. As discussed in our August 2017 newsletter, some people with MS turn to alternative treatments to manage their symptoms, most often in combination with their prescribed MS treatments. These therapies are often used for pain relief, fatigue and stress.

The National Multiple Sclerosis Society (the Society) is a non-profit organization based in New York City with chapters located throughout the United States. The organization funds research, provides education, and sponsors services that help people with MS and their families. They offer a number of resources to educate the newly diagnosed about many aspects of the disease, including a variety of informative brochures (highlighted below).
National Multiple Sclerosis Society Brochures

Diagnosis – The basic facts – Explains typical MS signs and symptoms, the tests used to diagnose MS (including how to prepare for an MRI), as well as the criteria for diagnosis.

What is Multiple Sclerosis? – Includes information about MS, including its symptoms, treatment, and what happens in the course of the disease.

Choosing the right healthcare provider – Outlines steps people with MS should take when choosing a healthcare provider and some tips for the first visit with them.

The disease modifying medications – Provides information on the disease-modifying treatments (DMTs) for MS, including how each one is taken, benefits and side effects. This brochure also includes information on financial assistance programs for DMTs and other medications for MS symptom management.

Disclosure – The basic facts – Discusses whom to tell about an MS diagnosis, the timing of the conversation and how much to reveal in both personal and work situations.

Connecting with others living with MS – Outlines resources available from the Society that can help one connect with other people with MS who may be in a similar situation.

The Society also offers a number of informative videos (for those who prefer this format).

National Multiple Sclerosis Society Videos

What is MS? – Explains the damage MS causes in the brain and spinal cord, which is what causes its varied and unpredictable symptoms.

Why does someone get MS? – Covers the risk factors for MS and some theories surrounding why one person or family member gets MS, while another doesn’t.

Tests for diagnosing MS – Describes the tests that are run to confirm a diagnosis of MS, as well as rule out other conditions that may mimic MS.

Magnetic Resonance Imaging – Describes magnetic resonance imaging (MRI), one of the main tests used to determine a diagnosis of MS.
A Diagnosis of Probable MS – Explores what a diagnosis of probable MS means and when a person may know with certainty they have the disease.

Coping with a diagnosis of MS – Answers the question, “What can an individual do to make a diagnosis of MS easier to deal with?”

Getting a second opinion – Covers the importance of getting a second opinion on a non-diagnosis of MS in the presence of MS symptoms.

Numerous helpful resources can be also found on the Society’s website. The Knowledge is Power (KIP) section of the website contains a free, downloadable educational series for people newly diagnosed with MS and their families. The program provides up-to-date facts about many aspects of MS, including MS treatments, employment, parenting, and relationships in the context of MS. KIP also has a section for family, friends and loved ones as they begin a new chapter living with the disease. The cost of MS medications and treatments can be a burden to those with inadequate insurance coverage. The Society’s website also includes a number of patient assistance programs available to those currently taking or considering starting an MS medication.

As discussed in our May 2018 newsletter, the Multiple Sclerosis Association of America (MSAA) is a nonprofit organization dedicated to improving the quality of day-to-day living for everyone affected by MS. They do this by providing a wide range of valuable services to the MS community free of charge. Their website contains information for those newly diagnosed with MS, as well as links to educational videos and webinars.

MSAA videos and webinars

What is MS? – Provides an overview of the disease, its history, and treatment information.

The MS Process – Explains how MS develops in the body.
**Diagnosing MS and monitoring disease activity** – Spells out the use of MRI to diagnose MS and the importance of clinical exams and patient feedback throughout the course of the disease.

**Relapse Management** – Describes the definition of an MS relapse, the decision to treat or wait for symptoms to resolve, and possible treatment options.

**FDA-Approved long-term treatment for MS** – Reviews the injectable, oral, and infusion therapies approved for MS, options for treating patients with different types of the disease; and important factors to consider when making a treatment decision.

**Wellness tips for MS patients** – Details the importance of wellness strategies including nutrition, exercise and sleep to help improve a person’s overall quality of life.

**Possible causes of MS** – Discusses theories behind infection, genetics, diet, and changes in the microbiome as possible causes for MS.

**Who gets MS?** – Explains the prevalence of MS in the United States and various factors that may influence one’s chances of getting MS, including gender, age and geography.

**Types of MS** – Provides an overview of relapsing-remitting MS and progressive forms of MS.

**The importance of long-term treatment in MS** – Discusses the goal for long-term MS treatment and the importance of shared decision-making to ensure the best health outcome.

**MS Symptoms** – Describes the physical, cognitive, and “invisible” symptoms of MS.

**How MSAA can help** – Provides an overview of MSAA’s supportive services for the MS community.

MSAA offers a variety of other resources that may shed light on questions those seeking to learn more about MS may have. Their [S.E.A.R.C.H. Program](#) helps individuals starting or changing MS treatments choose which medication to take in order to achieve the best
treatment outcome. Each letter of the program’s acronym represents an important topic that should be considered when making this decision – safety, effectiveness, access, risks, convenience and health outcomes. The MSAA Lending Library program offers a comprehensive selection of books and a variety of DVDs that cover disease and symptom management, wellness, personal stories from people living with MS, care partner issues, and many other important topics. Their lending policy makes these resources readily available. Participants can borrow one title at a time for up to 45 days. MSAA covers all outgoing and return mailing costs. In addition, MSAA offers an extensive library of on-demand videos, webinars and webcasts (in addition to those listed above) that offer a wealth of information that can be conveniently accessed online. MS Conversations is the official blog of MSAA. It includes posts from guest bloggers living with MS, as well as interactive discussions on topics of importance to people living with the disease. This blog is a good resource for people newly diagnosed and looking for a full picture of life with MS.

As discussed in our August 2017 newsletter, Can Do MS is a nonprofit organization based in Avon, Colorado whose mission is to provide every person affected by MS with the knowledge and tools they need to feel a sense of control over MS and have the best quality of life possible. They do this through a positive, “can do” philosophy coupled with a variety of lifestyle empowerment programs for people with MS and their families. Can Do MS offers a webinar, Managing MS Early: Get Ahead of the Disease that may be helpful to those newly diagnosed with the disease. As the name implies, this webinar covers how to stay proactive and get ahead of the disease. It offers suggestions on how to manage the physical, emotional and social changes MS may introduce into one’s life.

A number of books are available that may be useful resources for those that would like to educate themselves about the implications of an MS diagnosis. For example, MS: A Guide For The Newly Diagnosed is a guide to learning about the disease, its potential impact and the medical treatments available for managing it successfully (including alternative treatments). The First Year: Multiple Sclerosis: An Essential Guide for the Newly Diagnosed was written by Margaret Blackstone, who was diagnosed with MS in 2000. When she learned
she had MS, she educated herself about the disease. In her book, as a patient-expert, she guides those newly diagnosed step-by-step through their first year with MS.

Whether an MS diagnosis feels devastating or is a welcome explanation of mysterious symptoms, coming to terms with this life change can be challenging. A number of MS organizations offer a wide variety of resources and support to help those newly diagnosed with the disease better understand its scope and rise to meet its day-to-day challenges. With the help of these valuable resources, it is possible to lead a fulfilling life with MS.

What are the symptoms of MS and how is it diagnosed?

MS is a progressive, autoimmune disorder where the system designed to keep the body healthy (the immune system) mistakenly attacks the nerves in the brain and spinal cord. The protective covering of nerve cells (myelin sheath) is damaged, which interferes with the conduction of signals. This nerve damage can cause a myriad of symptoms that can be variable and unpredictable, depending on the location and extent of nerve damage. People with MS tend to have their first symptom between the ages of 20 and 40. No two people have exactly the same symptoms, and they can change over time. One person may experience only one or two symptoms while another person may experience many more. Some symptoms may come and go, while others linger. People with MS may have a single symptom that resolves for months or even years, without any other symptoms. On the other hand, some individuals experience multiple MS symptoms that worsen within weeks or months. Many MS symptoms are heat-related. For example, some may notice more symptoms in hotter weather, or as they warm up during exercise. These often go away when one gets out of the heat, or rests and cools down.
MS symptoms can be classified in three categories: primary, secondary and tertiary. Primary MS symptoms are caused by ongoing damage to the myelin sheath. Two primary MS symptoms that are often initial symptoms in those living with the disease are visual problems, as well as numbness and tingling. Visual problems (blurred vision, double vision or loss of vision) occur when the optic nerve is affected. MS can also damage other nerves in the brain and spinal cord, causing it to send conflicting signals around the body, or no signals at all, which results in tingling and numbness. Common sites of these altered sensations include the face, arms, legs, and fingers. Chronic pain is another common primary MS symptom, occurring in 65% of those living with the disease. As discussed in our March 2019 newsletter, 80% of people with MS experience fatigue and over half rank it as one of their most troubling symptoms. In some cases, it may be the most prominent symptom in a person who is otherwise minimally affected.

When nerve damage occurs along nerve pathways responsible for coordination of movement, a number of symptoms can occur. Spasticity is a feeling of stiffness and involuntary muscle spasm that most commonly occurs in the legs (but can occur in any limb). Tremor, or uncontrollable shaking, can also occur in various parts of the body. Weakness may be the result of nerve damage, or deconditioning of unused muscles. Nerve demyelination may cause a person to feel off balance or lightheaded. Less frequently, one may have the sensation that they or their surroundings are spinning (vertigo), most frequently upon standing up. Bladder dysfunction is another common primary MS symptom. Difficulties that may occur include frequent urination, strong urges to urinate, or incontinence. Constipation, as well as a loss of bowel control, may also occur in people with MS. As discussed in our March 2019 newsletter, up to 65 percent of people with MS struggle with cognitive dysfunction. This can include difficulties with memory, attention or organization.

Some less common primary MS symptoms include difficulties with speech, such as slurring (dysarthria), loss of volume (dysphonia) and stuttering. These typically occur later in the disease course and during periods of extreme fatigue. Problems with swallowing (dysphagia) may also occur as a result of damage to the nerves controlling the muscles in the mouth and throat. According to the National MS
Society, seizures occur in 2-5 percent of people with MS. These are the result of abnormal electrical signals in an injured or scarred area of the brain. Breathing problems, such as shortness of breath and difficulty breathing deeply, can occur in people whose chest muscles have been weakened by damage to the nerves that control those muscles. Other uncommon symptoms include hearing loss, headaches and sudden, intense itching.

While the primary symptoms of MS are the direct result of nerve damage, secondary MS symptoms are complications that can arise as a result of primary symptoms. For example, bladder dysfunction can lead to repeated urinary tract infections. Becoming less mobile can result in weakness and decreased bone density. While secondary symptoms can be treated, the best approach is to avoid them by treating the primary symptoms. Tertiary symptoms are a result of the social and psychological consequences of the disease. For example, a person who becomes unable to walk or drive may lose his or her job. The strain of dealing with chronic illness may disrupt personal relationships. Problems with bladder control, tremor or swallowing may cause people to withdraw from social interactions and become isolated. Some MS symptoms may have multiple causes. For example, sexual response can be affected by nerve damage. It also has the potential to be affected by other MS symptoms, such as fatigue and spasticity, as well as psychological factors in living with the disease. As discussed in our April 2019 newsletter, depression is common among people with MS. This can be a reaction to the stresses of living with MS as well as the result of neurologic and immune changes that occur due to the disease itself.

As discussed in our March 2019 newsletter, sleep is often disturbed in people with MS as a result of primary, secondary and tertiary MS symptoms. Lesions and nerve damage to key brain structures, as well as disruption of key neurotransmitters involved in sleep have the potential to interfere with getting a good night’s rest. People with MS are also prone to vitamin D deficiency, which has been linked to sleep disorders. However, additional research is needed to assess the relationship between vitamin D and sleep in people living with the disease. MS also causes a number of symptoms that indirectly disrupt sleep, such as restless legs, muscle cramps, pain, or urinary/bowel problems. People with MS often report becoming easily overheated. Awakening due to such temperature discomfort may also disturb one’s slumber. Insomnia may be a side effect of medications used to treat MS and its symptoms. For example, it is a common side effect of steroid treatments (used to
treat MS relapses). Stimulant medications often prescribed to treat MS-related fatigue can cause restlessness and sleep disruption. Increased napping during the day due to fatigue can interfere with a good night’s sleep, as well. Reduced physical activity due to fatigue and MS-related disability can have the same effect. In addition, those living with MS often struggle with depression, stress and anxiety, all of which have the potential to keep one awake at night.

Because MS affects every individual differently, it can be very difficult to diagnose. For many people, the first episode of what is often later diagnosed as MS is called **clinically isolated syndrome** (CIS). CIS is a single episode of neurologic symptoms due to demyelination of nerves in the brain and spinal cord. Symptoms depend on the location of the lesions and can range from barely detectable to disabling. The most common CIS symptoms are optic neuritis, **Lhermitte’s sign** (an electric, shock-like feeling that goes from the back of the neck to the spinal column), numbness and tingling. There are two types of CIS – a monofocal episode (individuals experience one symptom) or a multifocal episode (individuals experience more than one symptom). To be classified as CIS, the episode must last at least 24 hours and it can’t be associated with fever, infection, or other illnesses. It’s hard to distinguish CIS from MS based on symptoms alone. The big difference is that CIS is a single episode while MS involves multiple episodes, or flare-ups. CIS is sometimes the first clinical episode of MS, but not everyone with CIS develops MS.

To determine a diagnosis of MS, a neurologist typically performs a **neurological exam** (to check for impaired nerve function) and an eye exam (to evaluate vision and check for eye diseases). While no single laboratory test can confirm or rule out MS, tests to check for specific biomarkers associated with the disease are currently under development and may aid diagnosis in the future. One’s neurologist may order blood tests to help rule out other diseases with symptoms similar to MS. He or she may recommend a **spinal tap** (or lumbar puncture). In this procedure, a needle is inserted into the spinal column and spinal fluid is
removed for analysis. The presence of white blood cells in the fluid may indicate an inflammatory reaction resulting from MS. The presence of a pattern of antibodies called **oligoclonal bands** in the spinal fluid may also lead to an MS diagnosis. In addition, more specialized diagnostic procedures may be performed such as **evoked potential tests** which record the electrical signals produced by the nervous system in response to visual, auditory or painful stimuli. Electrodes measure how quickly this information travels down nerve pathways. Neurologists use **magnetic resonance imaging** (MRI) to look for damage to the **central nervous system** (CNS), as well as rule out other conditions. MRI provides specialized cross-sectional images of the brain and spinal cord using a powerful magnetic field and radio waves.

The **McDonald Criteria** is the guideline neurologists use to determine a diagnosis of MS. This guideline takes into consideration information from clinical evaluation as well as MRI scans to establish a diagnosis of MS. It requires evidence of damage over time (occurring on different dates) and in two or more parts of the CNS. The McDonald Criteria was first established in 2001 by neurologist Ian McDonald and has been revised over the years to reflect a better understanding of MS and improved MRI techniques. This guideline was developed using a white and Western patient population. Recent revisions have also improved the criteria’s applicability to other populations (pediatric, Asian and Latin Americans).

MS is very challenging to diagnose because it can vary both in severity and how it affects different people. Research shows early recognition and accurate diagnosis of MS are key to delaying disease progression as much as possible and improving outcomes. Early treatment helps to prevent accumulation of disability and irreversible neurologic damage. Unfortunately, misdiagnosis often occurs. A recent study looking at 241 people with an established diagnosis of MS concluded that almost 20 percent of them were misdiagnosed and, more likely, had another health condition.
Four disease courses have been identified in MS – CIS (described above), relapsing-remitting MS (RRMS), secondary progressive MS and primary progressive MS (PPMS). Most people with MS have a relapsing-remitting disease course, where they experience periods of new symptoms or relapses that develop over time and usually improve partially or completely. These relapses are followed by quiet periods of disease remission that can last months or even years. Most people with RRMS will eventually transition to a secondary progressive course in which there is a progressive worsening of neurologic function (accumulation of disability) over time. Some people with MS experience a gradual onset and steady progression of MS symptoms without any relapses, which is known as PPMS. Of note, although it is not part of the classification of MS, the term "benign MS" is used when people have had MS for many years without developing significant disability. Recent research suggests benign MS cannot be predicted early in the disease. As a result, the term is usually only used retrospectively, after people have done very well with the disease for many years.

MS has the potential to cause a variety of symptoms, many of which can be managed effectively with medication, rehabilitation and other management strategies. Recognizing the early symptoms of MS is key to improving outcomes. A number of disease modifying therapies have been shown effective in slowing disease progression and reducing the number of relapses an individual with MS may have. Those experiencing symptoms typical of MS should report them to their doctor immediately, as early diagnosis and treatment can help counter the disease’s intensity and progression.

When do MS symptoms start?

By Farren Briggs PhD, ScM

For MS epidemiologists, we are interested in identifying factors influencing the natural history (progression/severity) of MS. Alternatively stated: determining factors contributing to the manifestation of MS. And defining manifestation is where things get really interesting. What is the appropriate definition: It is disease activity? Is disease activity measured by number of relapses? Or is time between relapses more relevant? What about the rate of disability, such time from onset to using a walking cane? How about the diversity in symptoms and the patterns of symptoms? Well, these are all
important interpretations of the term. But to study the manifestation of MS, we must start at the beginning.

I teach an introductory class on epidemiology, and in one of my first lectures I introduce a conceptual framework of the natural course of a disease. Figure 1 is a hypothetical timeline of the natural history of a chronic disease with a genetic and environmental/lifestyle risk component; such as in MS.

![Figure 1: Natural history timeline of a chronic disease.](image)

In studying the natural history of MS, and resultantly MS progression, we should start at the beginning of the disease. But when does the disease start? For most of us, researchers or not, we generally conceptualize the start of MS as the first episode of neurological dysfunction (the first clinically noticeable symptom). However, as shown in Figure 1 there is the subclinical stage, where MS disease processes are ongoing but there has been no clinical event, therefore pre-clinical MS goes undetected. For some diseases, screening tests can be used to detect the disease while in the subclinical stage (i.e. mammography to detect breast cancer before symptoms even start). Developing screening tests for MS is an active research area, but in the meantime, are there other subtle symptoms and signs occurring during the subclinical stage to aid in detecting MS earlier?

In 2017, a Canadian research team reported there was a pre-clinical phase in MS\(^1\). The study used health administration records from four Canadian provinces (British Columbia, Saskatchewan, Manitoba, and Nova Scotia). Due to the nature of the Canadian health-care system, these provinces have computerized health-care records on >99% of residents, including hospital discharges, physician billing, prescription records, and dates of all medical visits – all records can be linked by a unique health-care number assigned to individuals. Using these records, medical histories for 14,428 MS cases and 72,059
controls were included for this study. They compared health-care utilization in the same five years period prior MS diagnosis between cases and temporally matched controls. Interestingly, five years before a MS diagnosis, the number of hospital admissions for people who eventually developed MS was 26% higher than controls, and this increased to 78% higher a year before MS diagnosis. A similar pattern was observed for physician billing (5 years before diagnosis: 24% higher in people with MS than controls; 1 year before diagnosis: 88% higher in people with MS than controls). There was also a substantial increase in the number of prescribed drug classes in people with MS compared to controls (5 years before diagnosis: 23% higher; 1 year before diagnosis: 49% higher). These results clearly demonstrated a pre-clinical stage for MS where subtle symptoms exist before clinically definitive symptoms (also known as a prodromal stage).

This same research group has since published a few more studies that aimed to add resolution to the 2017 findings. In a 2018 study², the researchers investigated which diagnostic codes were more common prior a confirmed diagnosis of MS in a similar Canadian study population. Individuals who eventually developed MS had a much greater occurrence of diagnosis codes related to spinal cord injury (e.g. 10-16x more diagnoses for ICD-9 952: Spinal cord injury without evidence of spinal bone injury), cerebrovascular disease, visual disturbances, Parkinson’s disease (e.g. 8-35x more diagnoses), urinary conditions (e.g. 2x more diagnoses for ICD-9 596: Other disorders of bladder), and muscular disorders 5 years prior to their diagnosis of MS compared to non-MS individuals. In a study from July of this year³, they saw similar results in a complementary analysis, including more health care encounters for nervous (130% increase), sensory (40% increase), musculoskeletal (20% increase), and genito-urinary systems (17% increase) 5 years prior a diagnosis of MS, including more visits to a psychiatrist and urologist (50% and 80% increase, respectively).

Collectively, these studies suggest that individuals who eventually develop MS are having a variety of health conditions in the years preceding onset of MS. It is possible that these early conditions reflect the earliest stages of MS, prior to the manifestation of classic neurological symptoms and MRI lesions. Thus, if we determine what combination of early diagnoses and symptoms might significantly predict MS, we can aim to start MS therapies much earlier and slow the accumulation of neurological disability.
How is MS Treated?

While there’s no cure for MS, there are many treatments available. These treatments, called disease-modifying therapies (DMTs) reduce but do not eliminate disease activity. MS treatment typically focuses on speeding recovery from attacks, slowing the progression of the disease and managing MS symptoms that may result from any remaining disease activity. Different people may have different types of MS. In addition, disease progression and symptoms vary greatly from person to person. As a result, each person’s treatment plan may be different. It’s important for people with MS on DMTs to notify their healthcare team of new or worsening symptoms as they may be indicative of MS progression, or other health conditions that may need to be addressed.

Several DMTs are available for the treatment of relapsing-remitting MS (RRMS). They can be taken by injection, infusion, or orally. These medications work by curbing the immune system so it doesn't attack the protective coating (myelin) that surrounds the nerves in the brain and spinal cord. They help lessen the frequency and severity of MS relapses, control disease progression and reduce MS symptoms. Research shows much of the immune response associated with MS occurs in the early stages of the disease, making early intervention important to ensure the most effective treatment. Many of the DMTs used to treat MS carry significant health risks. Selecting the right therapy depends on careful consideration of many factors, including duration and severity of disease, effectiveness of previous MS treatments, other health issues, cost, as well as whether or not one is pregnant, or intends to have children. Below is a list of the injectable treatment options for MS.

### Injectable DMTs

**Beta interferons** are some of the most common drugs used to treat MS. These include [Avonex](https://www.ncbi.nlm.nih.gov/pubmed/28434855), [Betaseron](https://www.ncbi.nlm.nih.gov/pubmed/30121490), [Extavia](https://www.ncbi.nlm.nih.gov/pubmed/29979093), [Plegridy](https://www.ncbi.nlm.nih.gov/pubmed/28434855), and [Rebif](https://www.ncbi.nlm.nih.gov/pubmed/30121490). They are injected under the skin (SC) or into the muscle (IM). Side effects of beta interferons may include flu-like symptoms and
injection-site reactions, but these typically fade within a few months. These medications lower the number of white blood cells in the body, which help the immune system fight illnesses. As a result, those taking beta interferons may be more likely to get an infection. As liver damage is another possible side effect of these medications, those on interferons must have routine blood tests to monitor liver enzymes. In addition, people taking these medications may develop neutralizing antibodies that can reduce their effectiveness over time.

Copaxone or Glatopa (its generic equivalent) must be injected SC. This medication has a chemical composition similar to the myelin sheath that surrounds nerve cells. Copaxone seems to block the immune system from damaging the myelin, but the exact mechanism is not well known. Copaxone is usually well tolerated and has fewer side effects than other DMTs. Such side effects may include skin irritation at the injection site.

There are a number of treatments for MS that are administered via intravenous infusion.

**Infused DMTs**

**Tysabri** is administered via infusion every 28 days to treat RRMS. It is used as a first line treatment for those with severe disease or as a second line treatment where other treatments have failed. Tysabri prevents immune cells from getting to the brain and spinal cord, where they can damage nerves. Side effects include headache, feeling tired, as well as joint or muscle pain. This medication increases the risk of a rare brain infection, called progressive multifocal leukoencephalopathy (PML), in people who are positive for JC virus (the antibodies to the agent that causes PML). Those who are negative for JC virus have almost no risk of PML.

**Ocrevus** is the only DMT approved by the FDA to treat both RRMS and primary-progressive MS (PPMS). This medication stops the immune system from attacking the body by targeting certain immune cells (B cells). Side effects may include respiratory tract infections, skin infections and depression. Ocrevus may also increase the risk of some types of cancer, particularly breast cancer.
**Lemtrada** helps reduce MS relapses by targeting a protein on the surface of immune cells and depleting white blood cells, thus limiting potential nerve damage they cause. Treatment involves five consecutive days of drug infusions followed by another three days of infusions a year later. Infusion reactions are common with Lemtrada and it has a long list of side effects. Due to its safety profile, it is only recommended for individuals who haven’t responded to two or more other MS treatments.

**Novantrone** is a chemotherapy that works by suppressing the immune system to lessen its attack on the myelin sheath that surrounds nerves. It is administered via infusion every three months. Common side effects include nausea, vomiting and hair loss. It’s important to note this drug can be harmful to the heart and is associated with development of blood cancers. As a result, it is only rarely used to treat severe, advanced RRMS.

For those that prefer not to use needles, there are also a variety of oral MS medications to choose from.

### Oral DMTs

**Gilenya** is a once-daily tablet used in the treatment of RRMS. Common side effects include headaches, diarrhea, back pain, cough, abnormal liver tests and an increased risk of PML. Because Gilenya slows heart rate, those taking this medication may need to have their heart rate closely monitored after the first dose.

**Aubagio** is another once-daily oral medication for RRMS that inhibits the function of specific immune cells. It is related to **Arava**, a drug used to treat rheumatoid arthritis. The most common side effects include diarrhea, nausea, and hair loss. This drug can also cause abnormal liver tests/liver damage and birth defects. Women who are pregnant should not take this medication, and those who may become pregnant should not take it without using appropriate contraception.

**Tecfidera** (formerly known as BG-12) is a twice-daily oral medication for RRMS that stops the immune system from attacking itself and destroying myelin. It may also have a protective
effect on the body, similar to the effect that antioxidants have. Side effects may include flushing, diarrhea, nausea and vomiting.

Mayzent is a once-daily oral medication that is approved for the treatment of RRMS and secondary-progressive MS (SPMS). It is thought to act by retaining certain white blood cells in the body's lymph nodes, keeping them out of circulation and out of the central nervous system. It also enters the brain and spinal cord, where it may have direct anti-inflammatory and other effects. Possible side effects include headaches, high blood pressure and liver problems. Mayzent is also harmful to a developing fetus, so women who are pregnant should not take this medication. Those who may become pregnant should use contraception when taking this medication and for ten days after stopping the medication.

Mavenclad is an anti-cancer therapy that is used to treat RRMS and SPMS. This medication is typically used by those not responding to, or intolerant of other DMTs. Mavenclad works by reducing the number of immune cells circulating in the body. It is an oral treatment given in two courses over two years, each consisting of two treatment weeks (spaced one month apart) at the beginning of each year. Side effects of Mavenclad treatment include, but are not limited to, headaches, upper respiratory tract infections, and insomnia.

Some healthcare providers may use medications that have been approved for other diseases to treat MS, also called "off-label" use.

Off-label MS treatments

Cellcept is FDA-approved for preventing rejection in patients receiving organ transplants. It works by blocking an enzyme that is needed for certain white blood cells to carry out an immune system attack. It is taken by mouth twice daily. There is evidence that Cellcept may reduce the number of MS relapses, new lesions and may slow disease progression. Side effects include increased risk of infection (including PML), nausea, difficulty sleeping, and swelling in the hands and feet. Of note, Cellcept is a teratogen, potentially causing fetal deformities or death.
**Cytoxan** is a chemotherapy used to treat various types of cancers. It is used off-label to treat a number of autoimmune conditions, including MS. It can be given intravenously or orally. It works by binding to cell DNA and interfering with cell division and replication. Research shows Cytoxan to be of benefit in progressive or worsening MS. **Side effects** include nausea, hair loss, changes in the skin or nails, and fetal abnormalities.

**Imuran** is an oral immunosuppressant that targets activation, proliferation, and differentiation of immune cells. It is used in combination with other medications to prevent organ rejection after kidney transplant and also for the treatment of rheumatoid arthritis. It has been used to treat MS outside of FDA approval for over 30 years. Several **clinical trials** have shown Imuran reduces relapse rate and disease worsening. **Side effects** include nausea, diarrhea, skin rash and hair loss. Imuran is not recommended for use during pregnancy as it may harm the fetus. Men and women should use two forms of birth control while taking this medication.

**Minocyline** is an oral tetracycline antibiotic that is approved for the treatment of a number of different types of bacterial infection. Research shows minocycline treatment in conjunction with Copaxone reduces the number of brain lesions, and this combination therapy is safe and well tolerated. **Side effects** include gastrointestinal problems, dizziness, increased skin sensitivity to the sun and a potential for fetal abnormalities.

**Rituxan** is a **monoclonal antibody** that targets a specific protein on the surface of white blood cells known to cause inflammation and damage in MS. It is FDA-approved for the treatment of some cancers, rheumatoid arthritis and certain types of vasculitis (inflammation of the blood vessels). In addition, it has been used off-label to treat both relapsing and progressive forms of MS. Rituxan is administered via two infusions separated by two weeks. This dosing regimen is then repeated every six months. Several **clinical trials** have demonstrated that Rituxan has significant benefit in reducing MS disease activity, and is safe for up to 2 years of therapy. **Side effects** include heartburn, night sweats, weakness and an increased risk of infections (including PML). Rituxan should be used with caution in pregnancy.

**Statins** are oral medications used to lower cholesterol. They are being studied in MS because they are known to modulate the immune system and to help support the growth, health and protection of nerve cells. There is **evidence** that simvastatin significantly reduces the rate of brain atrophy in SPMS, and is safe and well tolerated. **Side effects** include heartburn, gas,
headache and fetal abnormalities. Taking statins while pregnant or breast-feeding is not recommended.

MS relapses are caused by inflammation in the brain and spinal cord that damages the myelin coating around nerve fibers. This damage slows or disrupts the transmission of nerve impulses and causes the symptoms of MS. An individual suffering an MS relapse may experience a flare of their usual MS symptoms, or entirely new ones, depending on what nerves are affected. Most relapses will gradually resolve without treatment. For more severe relapses, neurologists may recommend a number of treatments.

**MS Relapse treatments**

**Corticosteroids**, such as Solu-Medrol (methylprednisolone) or Deltasone (prednisone), are the most common treatment for MS flares. Typically, the treatment regimen is a three to five day course of high-dose, intravenous corticosteroids to reduce nerve inflammation and end the relapse more quickly. This regimen may or may not be followed with a slow taper of oral prednisone. These drugs will calm the flare, but they won't slow the course of the disease. The side effects of corticosteroid treatment are numerous and may include increased appetite/weight gain, sudden mood swings, restlessness, osteoporosis, high blood pressure or difficulty sleeping.

**Plasmapheresis** may be the appropriate course of treatment if MS symptoms are new, severe and haven’t responded to steroids (or steroids can’t be used). This procedure involves removing whole blood from the body and filtering it to remove antibodies that may be attacking the nervous system. The “clean” blood is then given back as a transfusion. Plasmapheresis does carry some side effects, but, for the most part, they are mild and transient.

**H.P. Acthar Gel** injection is sometimes used to calm MS flares. Acthar is an adrenocorticotropic hormone (ACTH) analogue, believed to work by helping the body produce its own natural steroid hormones (which reduce the level of inflammation in the body). Acthar can be injected SC or IM. The side effects of H.P. Acthar Gel injections can be found [here](#).
Intravenous immunoglobulin (IVIG) treatment is sometimes used to treat MS flares. This is a sterile solution of concentrated antibodies extracted from healthy people that can be given intravenously (through a vein). Antibodies are proteins the body makes to help fight infections. It isn’t completely known how IVIG works. Experts believe it prevents abnormal antibodies directed against one’s own cells from working and also prevents immune cells from being active. There are a number of side effects associated with IVIG treatment, the majority are mild and resolve once the infusion is finished.

A wide variety of medications are used to help manage the symptoms of MS. The National MS Society website contains a list of common MS symptoms and the medications frequently used to treat them. However, medications aren’t the only answer. Some people with MS rely on physical therapy to learn stretching and strengthening exercises, which often help in many regards. A physical therapist can also provide instruction on how to use mobility devices to help manage leg weakness and other gait problems. A number of lifestyle changes can also make a big difference. It’s important for people with MS to keep a regular sleep schedule and get plenty of rest, eat a healthy diet and get regular exercise. Physical activity not only helps improve muscle strength, it also increases cardiovascular health, improves one’s mood and cognitive function. It’s important to note, however, exercise should be tailored to the individual and people with MS should not embark on a new regimen without first consulting with their physician. It’s essential for individuals with MS to manage the stress and emotional changes that accompany living with the disease, as they also have the potential to make MS symptoms worse. This can be done with medications, or therapy (or a combination of the two). The majority of people with MS have problems with aspects of thinking, such as memory, concentration or problem solving, at some point in the course of their disease. Our June 2019 newsletter discusses some helpful strategies and devices to help exercise one’s brain and maintain mental sharpness. Staying cool is vital when living with MS. Many find a rise in body temperature can make MS symptoms worse. Staying in the air conditioning is a good strategy, as well as wearing loose, breathable clothing in hot weather.

As discussed in our August 2017 newsletter, a number of alternative therapies are helpful in managing MS symptoms, most often in combination with prescribed MS treatments. For example, it is well known that vitamin D promotes calcium absorption for strong bones.
However, recent research also suggests Vitamin D may play a role in myelin repair and protecting the brain in people at risk for developing MS. Acupuncture is an age-old healing practice of traditional Chinese medicine in which thin needles are placed at specific points on the body. It is primarily used to relieve pain but also has been used to treat other MS symptoms. Studies show it can help MS symptoms like numbness, pain, muscle spasms, weakness and improving balance. Myelin becomes damaged in people with MS. Researchers in Poland found treatment with a myelin peptide skin patch significantly reduced disease activity in subjects with RRMS. Results suggest this treatment was safe and well tolerated.

Coping with MS isn’t easy at times, however successful treatment of MS and its symptoms can make a big difference in living with the disease. Effective MS treatments vary from person to person, what works well for one person won’t necessarily work for another. It’s important for people with MS to work with their healthcare providers to develop a treatment plan that addresses their physical symptoms and emotional outlook. This should be an ongoing dialogue throughout the disease course, as symptoms evolve.

Research Spotlight

EVENTS

Tisch MS Research Center of New York
22nd Annual MS Patient Education Symposium
22nd Annual Tisch MS Research Center of New York Patient Symposium

Every year the Tisch MS Research Center of New York hosts a free educational event for all people with MS, friends, family, caregivers, health professionals or anyone else that would like to learn more about the latest treatments, ways to manage MS symptoms and research initiatives for MS. This event will be held on Sunday, October 6, 2019, 9:30am – 1:00pm, at the New York Hilton Midtown. Speakers will include leading MS clinicians and Tisch MS researchers who will be sharing innovative therapies and research discoveries in the Tisch MS Laboratory. For more details or to register for the event, click here. Registration is also available at www.tischms.org/events or by calling 646-557-3919.

2019 Multiple Sclerosis Summit

The MS Coalition invites you to join us for the 2019 Multiple Sclerosis Summit on Saturday, November 9, 2019 at the Westin Lombard located at 70 Yorktown Center in Lombard, Illinois.

This day-long event includes informative workshops and an interactive expo for people with MS and their care partners. Access to all parts of the MS Summit, including breakfast, lunch, and parking, are free of charge.

EVENT SCHEDULE

Exhibit Hall & Complimentary Continental Breakfast
10:00 – 11:30am

Lunch Presentation
11:30am – 12:45pm
MS Research: You Shape the Future
Deborah Backus, PT, PhD, FACRM

**Workshops** (Select two)
1:00 – 5:00pm

- Mind over MS: Mood Cognition, and How to Cope
  Laura Hancock, PhD and Meghan Beier, PhD

- What to Expect as a Woman with MS
  Riley Bove, MD and Latoya Benita Stephens, MD

- Wellness and Self-Care for People with MS
  Amy Perrin Ross, APN, MSN, CNRN, MSC

- Wellness and Self-Care for Support Partners
  Rosalind Kalb, PhD

To learn more and register, please call 800-532-7667 x165, or visit: [http://ms-coalition.org/2019mssummit/](http://ms-coalition.org/2019mssummit/)

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**RESEARCH OPPORTUNITIES**

**CLINICAL NEUROSCIENCE LAB**

*The Ohio State University*

*Using neuropsychology and neuroscience to investigate mind-body approaches*

**Help us learn ways to improve thinking in people with MS**

**Purpose of this study:**
The Clinical Neuroscience Laboratory at The Ohio State University is conducting a 6-month study to potentially improve thinking in people with MS.

**Researcher:**
Dr. Ruchika Prakash, The Ohio State University

**Participating locations:**
Ohio State University, Columbus OH

**This study involves:**
- Wearing a device to monitor your step-count or water intake
- 5 study visits over a 6 month period, as follows
  - 2 visits before wearing the device
  - 1 visit while wearing the device
  - 2 visits immediately afterward
- Each visit will last about 3 hours, and will be scheduled at your convenience
- Parking will be covered
- Participants will be compensated

**Recruiting:**
Individuals must be diagnosed with relapsing-remitting MS, aged 30-59, with no other psychiatric or neurological illnesses

**Contact information:**
If you are interested in participating, please contact laboratory staff
  - By email: ra@clinicalneurosciencelab.com
  - By phone: (614) 292-9568
    By visiting the Clinical Neuroscience Laboratory’s [website](#)
Help us promote psychological wellbeing and mental health in people with MS!

A group of health care providers is interested in promoting the psychological wellbeing and mental health of every person with MS. They would like to better understand how people with MS from different backgrounds think about and experience mental health.

If you have MS and are 18 years or older, you are invited to complete a research survey and share your thoughts:

https://arcsapps.umassmed.edu/redcap/surveys/?s=8EEEMN4P3F

This survey should take about 30 minutes to complete. Your participation is entirely voluntary.

Your information will remain confidential and there will be no way of tracking your answers back to you. If you have any questions, please contact Daniela.PimentelMaldonado@umassmemorial.org.

This study is part of the University of Massachusetts Medical School.

Un grupo de profesionales de la salud esta interesado en promover el bienestar psicológico y la salud mental de todas las personas con esclerosis múltiple. Ellos buscan entender como las personas con esclerosis múltiple de diferentes orígenes piensan y experimentan el bienestar mental.

Si eres mayor de 18 años y tienes esclerosis múltiple, por favor comparte tu opinión contestando esta encuesta de investigación.

https://arcsapps.umassmed.edu/redcap/surveys/?s=8EEEMN4P3F
Completar la encuesta toma alrededor de 30 minutos. Tu participación es completamente voluntaria.

Tu información va a permanecer confidencial y no habrá forma de saber cuáles respuestas fueron tuyas. Si tienes alguna pregunta, favor de escribir a Daniela.PimentelMaldonado@umassmemorial.org.

Este estudio es parte de la Universidad de Massachusetts.
Healthy Mind, Healthy You

Most people experience stress at some point in their lives. Health problems like MS, heart disease, type 2 diabetes, obesity, high blood pressure, depression, and more, can become worse if people are experiencing stress.

Here's how you can help! Join a nationwide study, called Healthy Mind, Healthy You, that looks at how to use mindfulness to cope with stress. This could help people with more than 100 different medical conditions, including MS. The goal is to learn more about how mindfulness can reduce stress. In the study, subjects are randomly assigned to one of two online mindfulness programs, a three-session program or an eight-session program. People with MS, caregivers, and family members are all welcome to join, even if they are not members of iConquerMS.

If you’re interested in participating, act soon! The recruitment period ends 10/1. This study is just one of the many ways iConquerMS is facilitating and accelerating research on topics of importance to people affected by MS. If you are not already a member, please consider joining iConquerMS. Already a member? Stay tuned for new opportunities to participate in research!
Real MS™ (Research Engagement About Life with MS)

In the summer of 2016, the iConquerMS initiative launched REAL MS, a longitudinal study of MS. REAL MS participants complete detailed questionnaires online twice each year on a variety of subjects, including health history, diet, exercise and their experience with MS. This month, a seventh round of REAL MS surveys will be released through the iConquerMS portal. The information collected through these surveys will play a pivotal role in helping scientists and clinicians gain a better understanding of the health and quality of life over time for people with MS. Based on the premise that “Your Health Data Has Power,” this study is just one of the many ways iConquerMS is facilitating and accelerating research on topics of importance to people affected by MS. If you are not already a member, please consider joining iConquerMS. Your voice matters! Already a member? Please log in to your account and complete your open surveys!

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