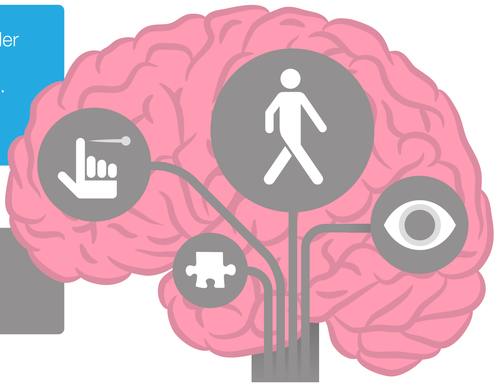
# Multiple Sclerosis (MS):

## A focus on four key measures of disease activity

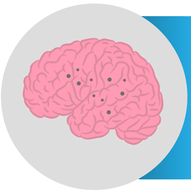
**Multiple Sclerosis** is a chronic disorder that disrupts the normal functioning of the brain, optic nerves and spinal cord. This is caused by inflammation and tissue loss[1]

MS can cause a range of both **physical** (e.g. walking) and **cognitive** (e.g. memory) problems[2]



This can significantly impair the quality of life of the individual and their families. In fact, **only ~50%** of people with MS will be employed 10 years after diagnosis[3] and **two-thirds** say having MS has affected their jobs[4]

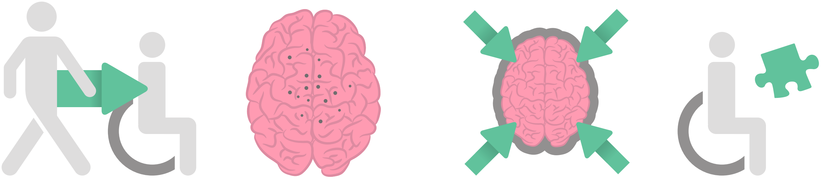
There are **2 main types of damage** in MS that contribute to widespread loss of neurons and physical and cognitive dysfunction.



**Focal:** Distinct inflammatory lesions can clinically manifest as acute attacks (relapses)[5-7]

**Diffuse:** Ongoing, widespread damage that starts early in the disease[5-7]

# 4 key measures of disease activity that help assess the impact of focal and diffuse damage on the patient's brain



### Relapses

Relapses may have an acute disabling impact on an individual's life. Incomplete recovery from a relapse can significantly advance the level of disability[8]

### MRI lesions

The amount of MRI lesions has been shown to be associated with relapses and therefore disability[9]

### Brain shrinkage

Brain shrinkage (brain volume loss) predicts and correlates with long-term physical disability as well as cognitive dysfunction[10]

### Disability progression

Common symptoms include physical and cognitive problems[2]

Addressing these four measures through **early and effective treatment** and **appropriate disease management** is important to **impact the course of MS** and preserve what matters most to patients: **their physical and cognitive function**


### References

1. http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001747/. Accessed August 2014.
2. http://www.nationalmssociety.org/Symptoms-Diagnosis/MS-Symptoms/. Accessed August 2014.
3. Naci H, et al. Economic burden of multiple sclerosis: a systematic review of the literature. Pharmacoeconomics. 2010;28(5):363-79.
4. MS in Focus, Issue 16: Employment and MS. http://www.msif.org/includes/documents/cm_docs/MSinFocusIssue16EN.pdf/. Accessed August 2014.
5. Filippi M, et al. Association between pathological and MRI findings in multiple sclerosis. Lancet Neurol. 2012 Apr;11(4):349-60.
6. Kutzelnigg A, et al. Cortical demyelination and diffuse white matter injury in multiple sclerosis. Brain. 2005 Nov;128(Pt 11):2705-12.
7. Sormani M.P., Arnold DL & De Stefano N. Treatment effect on brain atrophy correlates with treatment effect on disability in multiple sclerosis. Ann Neurol. 2014 Jan;75(1):43-9.
8. Lublin F.D., Baier M., Cutter G. Effect of relapses on development of residual deficit in multiple sclerosis. Neurology. 2003;61(11):1528-1532.
9. Sormani M.P. & Bruzzi P. MRI lesions as a surrogate for relapses in multiple sclerosis: a meta-analysis of randomised trials. Lancet Neurol. 2013 Jul;12(7):669-76.
10. Popescu V. et al; on behalf of the MAGNIMS Study Group. Brain atrophy and lesion load predict long term disability in multiple sclerosis. J Neurol Neurosurg Psychiatry. 2013 Mar 23.


NOVARTIS PHARMACEUTICALS