

For the Primer, visit doi:10.1038/s41572-020-00231-4

➔ **Myopia (short-sightedness) occurs when excessive elongation of the eye results in distant objects coming into focus in front of, rather than at, the retina, leading to blurred distance vision.**

**EPIDEMIOLOGY**

The global prevalence of myopia was almost 30% in 2010 and is expected to increase to almost 50% by 2050. An 'epidemic' of myopia has been described in some regions of Southeast Asia, with a prevalence of ~97% in 19 year olds in South Korea and 86% in 18–24 year olds in Taiwan. Prevalence is often lower in regions outside of Asia, such as 35% in Norway, ~33% in the USA and ~28% in Israel. This variation is reportedly due to differences in the risk factors for myopia, particularly, education and other near-work activities.

! **The prevalence of high myopia, a more severe form of myopia, was ~4% globally in 2010**

**DIAGNOSIS**

Myopia typically develops in childhood or early adulthood. Diagnostic work-up involves visual acuity testing, ocular examination and refraction. Refraction is used to determine the eye's refractive error, which is used to classify the level of myopia; a refractive error of  $\leq -0.5$  Diopter is diagnostic of myopia, whereas a refractive error of  $\leq -5.0$  D or  $\leq -6.0$  D is diagnostic of high myopia. High myopia is associated with a high risk of adverse ocular tissue changes, such as chorioretinal atrophy and macular atrophy, which should be detected by fundus examination. Patients with these retinal changes are diagnosed with pathologic myopia.

**MECHANISMS**

**Myopia is strongly associated with educational attainment or intensity and other 'near-work' activities (such as reading, writing and watching television). By contrast, outdoor exposure is a protective factor against myopia, although the mechanisms are not fully understood.**

**PREVENTION**

Policies and programmes that encourage schools to increase the time children spend outdoors may be effective for myopia prevention; in one such programme in Taiwan,

increasing the time schoolchildren spent outdoors by 80 minutes per day reduced incident myopia by 53% after 1 year. Such policies and programmes have also been

trialled in Guangzhou, China, and are being adopted across other regions of Asia.

**Rx MANAGEMENT**

Optical interventions (such as contact lenses or spectacles) for myopia are widely available and can restore visual acuity to enable normal distance vision but do not slow myopia progression. By contrast, orthokeratology lenses can both restore visual acuity and slow the progression of myopia by decreasing the rate of eye elongation. Pharmacological treatments include high-dose or low-dose atropine, which slows myopia progression, although the underlying mechanism of action is unknown. Surgery can be used in adults with stable myopia. Two types of surgery are routinely used: keratorefractive procedures, in which lasers alter the curvature of the cornea, and intraocular procedures, in which intraocular lenses are used.

**Genetic risk factors for myopia include variants in genes involved in development of the eye, ion transport and extracellular matrix remodelling, among others.**

**How these factors correspond to excessive eye elongation is poorly understood, but visual stimuli (such as near-work) may induce changes in neurotransmitters, cytokines and connective tissue components that are involved in growth of the eye during childhood.**

**OUTLOOK**

Owing to the increasing incidence of myopia globally, it is very likely that the incidence of high myopia and pathological myopia will also increase. Identifying which patients are at higher risk of high myopia and pathological myopia is essential to prevent the adverse ocular changes that can occur in these disorders.