Non-Communicable Diseases Watch

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衞生防護中心 Centre for Health Protection

衞生署 Department of Health

Can You See Clearly, Kid ?

Key Messages

※ Refractive errors are a group of conditions in which light rays fail to focus on the retina and result in blurred vision. For children, the major types of refractive errors include myopia (or short-sightedness), hyperopia (or long-sightedness) and astigmatism.

※ The onset and progression of refractive errors during childhood is largely influenced by genetic predisposition (such as family history of refractive errors), behavioural risk factors (such as poor reading habits and lack of outdoor activities) and environmental exposures (such as exposure to maternal smoking during pregnancy), but most probably an interaction of both nature and nurture.

※ Among children in Hong Kong, refractive errors are very common, particularly myopia. Studies found that the prevalence of myopia among preschool children aged 2 to 6 years significantly increased from 2.3% in 1996/1997 to 6.3% in 2006/2007. For schoolchildren aged 6 to 12 years, prevalence of myopia increased progressively with age from 18.3% at age 6 to 61.5% at age 12. High myopia also increased with age from less than 1% among schoolchildren aged 6 to 7 years to 3.8% for those aged 11 to 12 years.

※ Uncorrected and severe refractive errors may lead to other eye problems. Parents and carers can play a key role in protecting their children's vision through early recognition of vision problems, taking children to preschool vision screening and regular eye checks, providing an eye friendly environment at home and nurturing children's good eye care habits.

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Can You See Clearly, Kid ?

Healthy eyes and vision are a critical part of children's development. Visual problems interfere with children's daily activities and can affect learning ability and adjustment in school. Globally, uncorrected refractive errors are the main cause of moderate and severe visual impairment. As the World Health Organization estimates, 12 million children below age 15 are visually impaired due to refractive errors.[1]

Global Situation of Refractive Errors among Children

The refractive errors are a group of conditions in which light rays fail to focus on the retina (a light-sensitive layer of tissue at the back of inner eye where light rays are converted into nerve impulses travelling along the optic nerves to the brain for interpretation) and result in blurred vision. They can be easily diagnosed and corrected with appropriate eyeglasses or other corrective measures.[2] For children, the major types of refractive errors include myopia (or short-sightedness), hyperopia (or long-sightedness) and astigmatism (Box 1).

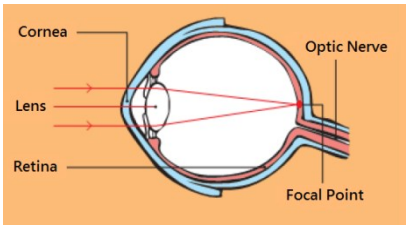
Although epidemiological studies have used various definitions, eye examination procedures or data collection methods, they generally observed that children of certain age groups, ethnicities and geographical areas would have higher rates of refractive errors.[3, 4]

Myopia

Myopia is a condition in which people have difficulty in seeing distant objects clearly. It is usually caused by an eyeball that is too long, causing light rays from a distant object to focus in front of the retina rather than on it. As a result, the image of distant object appears blurred. Myopia generally starts in the early to middle childhood years, but significant myopia can also develop in the late teenage years or early adulthood. For high myopia, it is associated with other eye conditions, such as peripheral retinal changes, cataract and glaucoma.[3, 5]

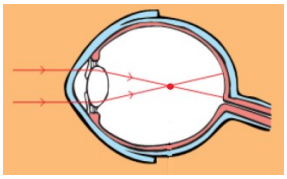
Box 1: Schematic illustration of a normal vision, myopia, hyperopia and astigmatism

Normal Vision



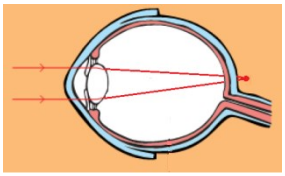
Light rays pass through the lens and are focused on the retina, resulting in a cleared image

Myopia



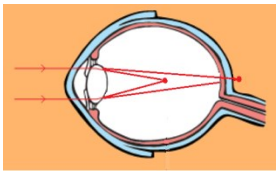
Light rays are focused **in front of** the retina, resulting in a blurred image

Hyperopia



Light rays are focused **behind** the retina, resulting in a blurred image

Astigmatism



Light rays **cannot focus** on the retina, resulting in a blurred image

Among children, myopia is a common visual problem.[3] In studies with similar definitions, measurement procedures and sampling strategies, prevalence of myopia ranged from 1.2% in rural Nepalese children aged 5 to 15 years, to nearly 18% among children aged 12 to 13 years in Northern Ireland and about 38% in urban Chinese children aged 5 to 15 years.[6]

Hyperopia

Hyperopia occurs when the length of an eyeball is too short so that light rays from a distant object are focused behind the retina, resulting in a blurred image. People with mild hyperopia can see both far and near objects clearly by accommodation of the eyes to adjust the focus forward to the retina. On the other hand, people may complain that both far and near objects are blurred, if they have high hyperopia or eye strain resulting in diminished accommodation. Hyperopia is often present at birth, but usually gradually decreases with age. However, persistent hyperopia can precipitate amblyopia (or lazy eye) and strabismus (or crossed eyes).[4, 7]

Among 6 year-old schoolchildren, studies observed that the prevalence of moderate hyperopia ranged from 2% to 3% in Nepal and South Africa, to about 13% in Australia (Sydney) and 20% to 26% in Chile. Among 12 year-old schoolchildren, the corresponding prevalence also varied from less than 1% in Malaysia and Nepal to over 10% in Chile.[8]

Astigmatism

Astigmatism occurs due to irregular curvature of the cornea or the lens. Instead of being a perfect sphere, the vertical curvature of the cornea is different from that of the horizontal. Consequently, vision becomes blurred at any distance. Astigmatism can present at birth and usually resolves between 1 and 6 years. While astigmatism often occurs together with myopia and hyperopia, high astigmatism may lead to amblyopia.[7, 9, 10]

Studies showed that prevalence varied from 39% among children aged 6 or below in the United States, to 19% among Singapore schoolchildren aged 7 to 9 years and less than 4% among children aged 15 years or below in India.[11]

Risk Factors of Refractive Errors

The onset and progression of refractive errors during childhood is largely influenced by genetic predisposition (such as ethnicity and family history of refractive errors), behavioural risk factors (such as poor reading habits and lack of outdoor activities) and environmental exposures (such as exposure to maternal smoking during pregnancy and level of urbanisation), but most probably an interaction of both nature and nurture.[12]

Parental influences

Parental myopia is considered to contribute to their child's myopia development through genetic and environmental factors (such as long hours spent on near work like reading or less time spent outdoors).[6] Studies showed that children with one or two myopic parents were about 2 to 8 times as likely to develop myopia as children with no myopic parents.[13-16] An Australian study of 12 year-old children from different ethnic backgrounds also observed the effect of level of parental myopia on their children's risk of myopia. Compared to children with no myopic parents, children having at least one mildly, moderately and highly myopic parent were about 6, 10 and 22 times as likely to be myopic respectively.[13]

Behavioural risk factors

Prolonged time spent in near-work activities (such as reading and computer use) has long been regarded as a risk factor of childhood myopia.[3, 5, 16] Bad visual habits accelerate the development of refractive errors. An Australian study found that schoolchildren who read at a close distance (<30 cm) were 2.5 times as likely to become myopic compared with those who read at a distance ≥30 cm.[17]

Contrariwise, outdoors activity protects against myopic development and progression. A systematic review and meta-analysis found that an additional hour of time children and adolescents spent outdoors each day would reduce their myopic risk by 13%.[18]

Environmental exposures

Maternal smoking during pregnancy is a well-known risk to the developing foetus. Studies also linked exposure to maternal smoking with childhood hyperopia and astigmatism. Compared to children whose mothers did not smoke during pregnancy, children whose mothers smoked during pregnancy would have 40% to 50% increased risk of hyperopia or astigmatism.[8, 19, 20] Level of urbanisation is also an important environmental risk factor with studies reporting higher myopia prevalence among people living in urban cities compared with those living in rural or remote settings.[6]

Hong Kong Situation

Refractive errors are very common among local children, particularly myopia with earlier onset and higher prevalence compared with their Western counterparts.[21-24]

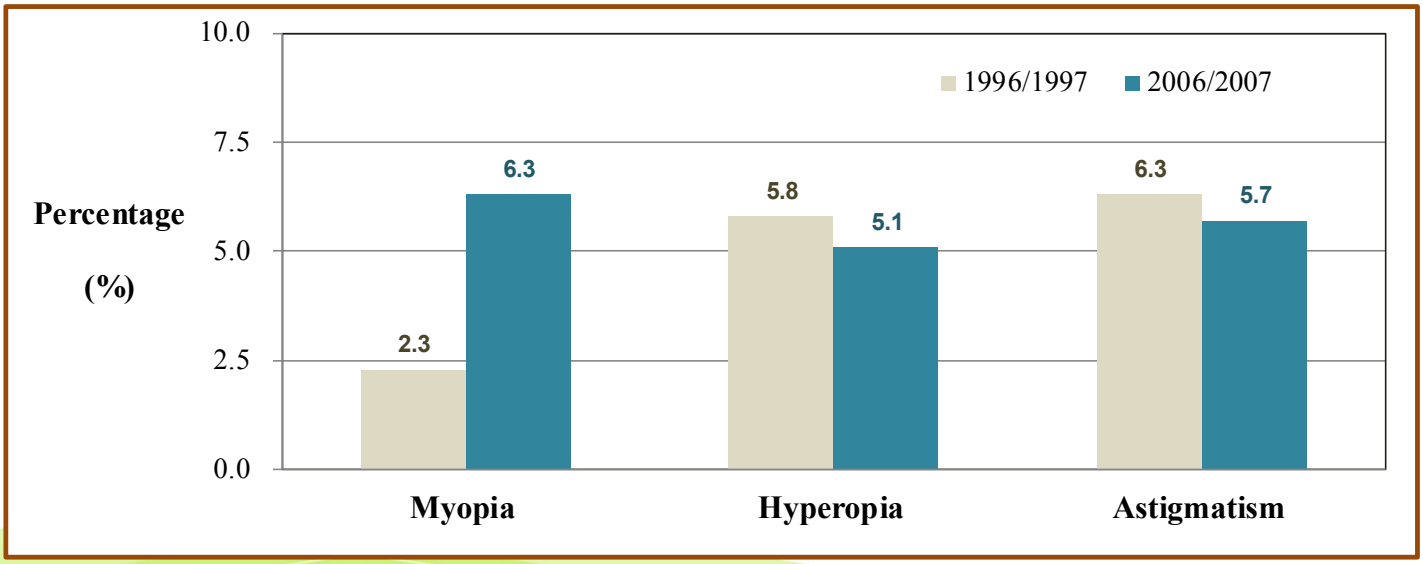
Preschool children

To determine the prevalence of visual problems among preschool children, a study conducted ocular examinations on 601 and 823 Hong Kong preschool children aged 2 to 6 years in the school years 1996/1997 and 2006/2007 respectively. Results showed that 17.0% of preschool children had visual problems, including refractive errors, amblyopia and strabismus. In 10 years, there was a significant increase in the prevalence of myopia from 2.3% to 6.3%. Although the prevalence of hyperopia or astigmatism dropped over the same period, both downswings were not statistically significant (Figure 1).[22]

Schoolchildren

A study analysed data from 2 651 Chinese schoolchildren aged 6 to 12 years who participated in vision screening during the period of 2005 to 2010. Results showed that the overall prevalence of myopia and hyperopia were 47.5% and 8.1% respectively. Prevalence of myopia increased progressively with age from 18.3% at age 6 to 61.5% at age 12. High myopia also increased from less than 1% among schoolchildren aged 6 to 7 years to 3.8% for those aged 11 to 12 years. In contrast, prevalence of hyperopia decreased from 15.9% at age 6 to 4.9% at age 12 (Table 1).[24]

Figure 1: Prevalence of myopia, hyperopia and astigmatism among Hong Kong preschool children aged 2 to 6 years, 1996/1997 and 2006/2007



Source: Fan et al 2010.

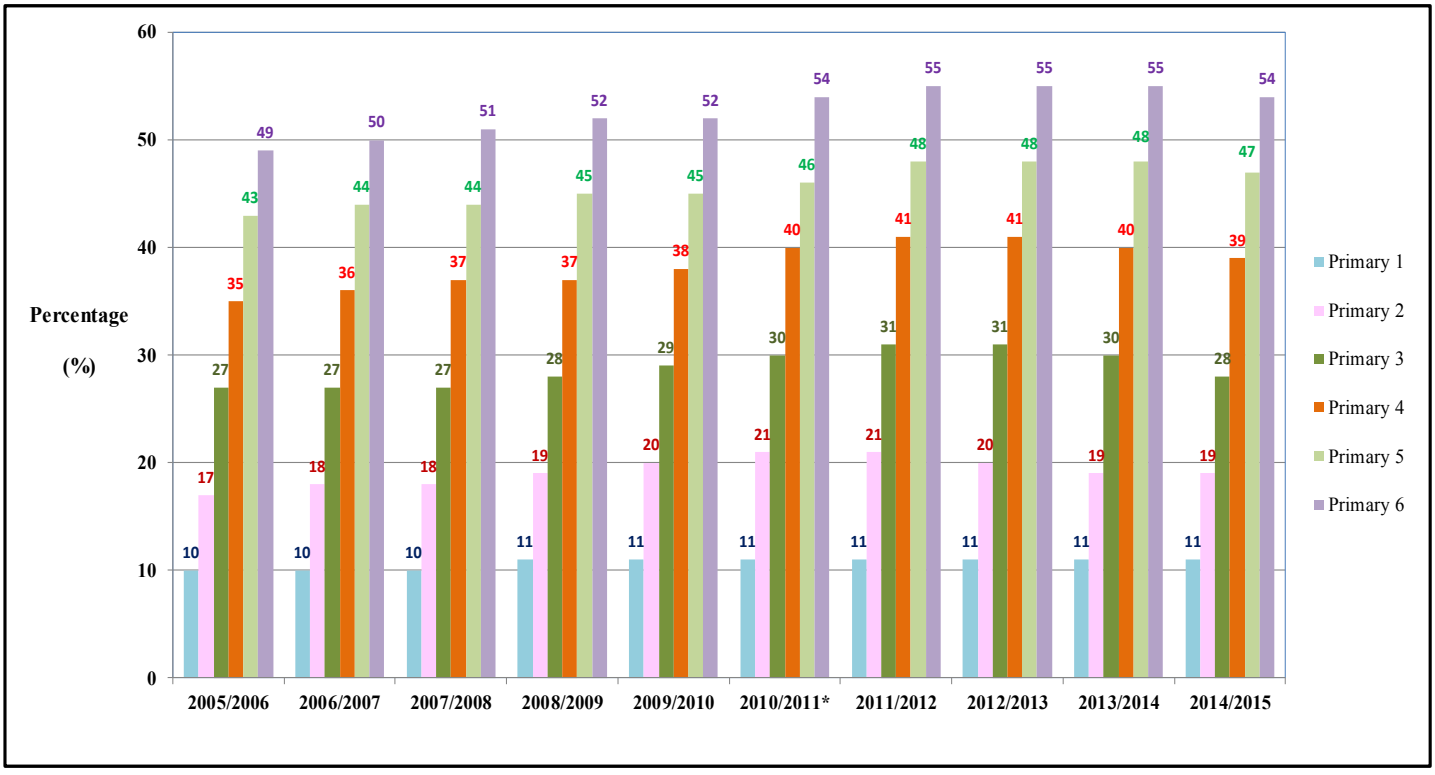
Table 1: Prevalence of myopia and hyperopia among Hong Kong schoolchildren aged 6 to 12 years during the period of 2005 to 2010

	Age (years)						
	6	7	8	9	10	11	12
Myopia	18.3%	26.4%	46.4%	51.4%	59.3%	63.9%	61.5%
High myopia	*0.7%*	*0.0%*	*1.4%*	*1.6%*	*1.7%*	*3.8%*	*3.8%*
Hyperopia	15.9%	13.8%	6.1%	6.8%	7.3%	3.3%	4.9%

Source: Lam et al 2012.

The Student Health Service (SHS) of the Department of Health (DH) provides visual acuity screening for all primary school (and secondary school) students during their annual health checks. As shown in Figure 2, the percentages of primary school students who were wearing glasses (including glasses that correct visual problems such as myopia, astigmatism, myopia with astigmatism) in the past 10 school years increased with school grade, from 10% to 11% among Primary 1 students to 49% to 55% among Primary 6 students.[25]

Figure 2: Percentage of primary students with wearing glasses, 2005/2006 to 2014/2015



Note: *Since school year 2010/2011, wearing glasses also included contact lenses, glasses at home, Ortho-K lenses, etc.

Source: Student Health Service of the Department of Health.

Protecting Children's Vision

Although refractive errors are to some extent inherited, parents and carers can play a key role in protecting their children's vision through early recognition of vision problems, taking children to preschool vision screening and regular eye checks, providing an eye friendly environment at home and nurturing children's good eye care habits.

Early recognition of refractive errors

Children, especially younger ones, may not realise their vision problems, parents are thus best placed to spot the early signs of refractive errors. They may include:

- Complaints of headaches, eyestrain, blurred or doubled vision;
- Frequent blinking or rubbing of eyes;
- Difficulty in seeing objects faraway (such as road signs or a blackboard at school) or nearby (such as holding a book very close to read, leaving out or confusing words when reading);
- Tilting of head or squinting to see properly;
- Covering up one eye when reading or watching television;
- Poor eye-hand co-ordination.

Preschool vision screening and regular eye checks

Parents and carers must not overlook the importance of preschool vision screening and regular vision checks.

∗ The visual system continues to develop after birth and matures by about 8 years of age. Preschool vision screening can help to detect visual problems early, including high refractive errors, amblyopia and squint in young children. Affected children can receive earlier treatment to protect their future vision development.[7]

The Family Health Service (FHS) of DH provides vision screening for preschool children at 4 years of age or above by registered optometrists or orthoptists at the Maternal and Child Health Centres. If significant refractive errors, squint or amblyopia are suspected, the affected children would be referred to eye clinics for further assessment. To know more about the Preschool Vision Screening, please visit the FHS website at www.fhs.gov.hk, or call the 24-hour Information Hotline at 2112 9900.

∗ All schoolchildren, even those who passed the preschool vision screening (as some preschool children may develop visual problems at later age), should have their eyes and vision regularly checked by qualified eye doctors or optometrists through their school years. A study assessing the cost and effects of various visual screening strategies for refractive errors showed that screening of 5 to 15 years old children would yield most health effects, while screening children of 11 to 15 years old is the most cost-effective intervention due to their high prevalence of refractive errors.[26]

The SHS of DH provides free annual health assessment, including vision acuity screening, for students who participate in the SHS. Those who fail the visual acuity screening will be referred to the DH's Special Assessment Centres for further visual assessment. For details, please visit the SHS website at www.studenthealth.gov.hk.

Provision of an eye friendly environment at home

A healthy home environment is essential to eye health.

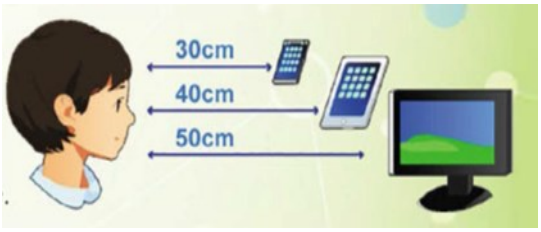
- Set limits on screen time. As recommended, children younger than 2 years old should avoid screen time as much as possible; children aged 2 to 6 years old should limit screen time to no more than 2 hours a day; children aged 6 to 12 years old should limit recreational screen time to no more than 2 hours a day, whereas those aged 12 to 18 years should avoid prolonged screen time.
- Choose chair and desk that suit children's height and ensure optimal lighting (even and bright without excessive glare) when children are engaging in near-work activities.
- Take children to play outside more often, such as bringing them to parks or outlying islands for hiking or other outdoor activities.
- Do not smoke. Among other health problems, exposure to maternal cigarette smoking increases the risks of visual problems in children.
- Provide children with a balanced diet that is rich in fresh fruit and vegetables (especially bright-coloured fruits and vegetables like water-melon, papaya, carrot, tomato and cantaloupe; and green leafy vegetables like spinach and kale) with appropriate amounts of fish and dry-roasted plain nuts. These foods contain important nutrients such as antioxidants, β-carotene and omega-3 fatty acids that may help maintaining eye health.
- Do not give children eye drops without consulting health care workers.

Nurturing good eye care habits

Good habits once established would benefit a person for a lifetime. For a lifetime of good vision, it would be good for children to develop good eye care habits from a young age.

Parents and carers should teach children [27]:

- ✓ Proper reading and writing postures (e.g. sitting upright and at least 30 cm between the eyes and a book or smartphone; 40 cm for a tablet personal computer; 50 cm for a computer).



- ✓ Always read in a room with good and even lighting. Do not read in moving vehicles, under strong light or when lying down.
- ✓ Take breaks from near-work activities. Rest eyes regularly by taking a break of 20 to 30 seconds or looking at distant objects after every 20 to 30 minutes of near-work activities. Blink eyes and do eye muscle relaxation exercise.
- ✓ Avoid eye rubbing. Never use public towels to wipe the eyes and other people's eye drops. Do not cover the eyes with hair.
- ✓ Do not look directly at strong light. Wear a broad-brimmed hat and sunglasses when playing under strong sunlight to protect their eyes from damaging ultraviolet rays.
- ✓ Wear appropriate eyewear or face guard to protect against eye injuries when playing eye hazardous sports or recreational activities.
- ✓ Have enough sleep to reduce eyestrain.

Of note, uncorrected and severe refractive errors may lead to other eye problems. Thus, it is important to prevent and control refractive errors. For children, wearing eyeglasses is the most common method used to correct refractive errors. For some tips on how to choose frames and lenses for eyeglasses, please visit the designated webpage at the SHS web-site http://www.studenthealth.gov.hk/english/health/health_ev/health_ev_eg.html.

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WORLD SIGHT DAY

World Sight Day (WSD) is an international day of awareness coordinated by the International Agency for the Prevention of Blindness (IAPB). It is held annually on the second Thursday of October to focus attention on the global issue of avoidable blindness and visual impairment.

WSD 2016 will be on 13 October 2016. The theme is '**Universal Eye Health**' which is in keeping with the World Health Organization's Action Plan 2014-2019 and this year's call to action is '**Stronger Together**'. For more information about WSD 2016, please visit **http://www.iapb.org/wsd16**.

This year too, IAPB invites amateur and professional photographers to photo-document the impact of eye health in people's lives by taking part in an International Photography Competition with theme '**#StrongerTogether**'. People who are interested in taking part can visit the designated website **http://photocomp.iapb.org** for details about the IAPB photo competition, and to upload and share their pictures by 13 October 2016.

Non-Communicable Diseases (NCD) WATCH *is dedicated to promote public's awareness of and disseminate health information about non-communicable diseases and related issues, and the importance of their prevention and control. It is also an indication of our commitments in responsive risk communication and to address the growing non-communicable disease threats to the health of our community. The Editorial Board welcomes your views and comments. Please send all comments and/or questions to so_dp3@dh.gov.hk.*