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Invited Commentary

2020 as the Year of Quarantine Myopia

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Although reports on coronavirus disease 2019 (COVID-19) affecting health already exceed 32 000 articles, studies on direct effects on the eye appear to be limited.¹ Conjunctivitis, retinitis, episcleritis, and optic neuritis have all been described as ocular manifestations, but frequency and morbidity are fortunately not striking. This has relieved us as ophthalmologists and given the impression that we have been spared a heavy patient load attributable to COVID-19 complications. We have focused on reorganizing our clinics and made sure that anti-vascular endothelial growth factor treatments and other urgent patient care were not obstructed.

In this issue of *JAMA Ophthalmology*, Wang et al² are telling us another story. They suggest we should be worried about the ophthalmic outcome of COVID-19, not from the virus itself but from the potential outcome of an antiviral measure on eye health, specifically an outcome in children that may have major consequences for visual acuity later in life. China, followed

by other Asian countries, was the first to experience the severe virus outbreak, the first to start closing schools and imposing home confinement, and the first (to our knowledge) to report the potential consequences of these actions on myopia. For the eye, this appears to be development of myopia at a young age; particularly, an early onset potentially increases the burden.

What Wang et al² are reporting reflects an impressive scientific achievement. In China, a complete lockdown with home confinement took place from January to May, and schools reopened in June. During this 1 month, the examiners performed noncycloplegic photorefractive in schoolchildren aged 6 to 13 years; during the 3 months that followed, they analyzed all data and prepared for publication. The study was part of a yearly survey that started in 2015 and was in its totality truly big data (N = 123 535). A slight but potentially relevant omission is the number of children who participated each year, particularly this year. It is therefore unclear whether the number of participants in 2020 is the same as in other years, which would provide greater confidence of a fair comparison. Also, cycloplegic refractions are the gold standard in defining myopia in this age group.



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To assess temporal trends across age groups, the authors² calculated the mean spherical equivalent for each age at each year and estimated the prevalence of myopia. Overall, it is important to note the high proportion of myopia in these Asian children who are still in elementary school. At age 13 years, more than 80% already had myopia, while the prevalence at this age in European children is 25%. At all ages, mean refractive error involved greatest myopia in 2020, in girls even more so than boys. Most compelling, however, were the data in 6-year-old children. Their mean refractive error changed only slightly from the hyperopic side of 0 in 2019 to the myopic side this year. Nevertheless, this myopic shift had a large association on the prevalence of myopia (SE < -0.5D), as it jumped from 3.5% to 5.7% in 2015 to 2019 to 21.5%, an almost 400% increase, in 2020. For 7-year-old and 8-year-old participants, this increase was also considerable: 200% and 40%, respectively. At older ages, the 2020 surplus was not apparent, but at these ages, the total myopia prevalence was already substantial in the years prior to 2020. Taken together, the prevalence data after the COVID-19 lockdown in China suggest an earlier onset for a large proportion of children. This age shift is highly clinically relevant, in that it is well recognized that age at onset corresponds closely to final refractive error at adult ages. Likewise, the higher the refractive error, the more likely the occurrence of sight-threatening complications, such as myopic retinal degeneration, glaucoma, and retinal detachment. Given that 1 in 3 people with high myopia becomes severely visually impaired, mostly at working age, it is clear that China is facing a serious public health problem. Much of the rest of the world may be likely to follow.

Quarantine home confinements happened all over the world in the first 5 months of 2020. Some countries did not allow leaving the house at all; others were more lenient. A number of studies reported on lifestyle during this time. A Canadian study assessed physical activity, outdoor time, screen time, and social media use in children by questionnaire during the lockdown.³ Eight-year-olds spent a mean of 5.14 h/d on screens for leisure, and 83.5% consumed more

than the recommended screen time limit of 2 h/d. Parents reported a decrease in healthy behavior, most dramatically for outdoor activity and sport. This study also showed a sex difference: girls spent more time on screens and social media and less time on physical activity. Other studies at other parts in the world published similar reports on increased screen time and decreased outdoor play by children during strict COVID-19 regulations.⁴⁻⁶ The observation that COVID-19 induces lifestyle changes, as well as an increase in myopia prevalence, makes a strong case that these 2 pandemics are linked and fit the current understanding of myopiogenesis.

Why did Wang and coauthors² only find relevance for the 2020 myopia increase in 6-year-old to 8-year-old children? The older age groups were also home confined, with even more online education. We speculate 2 reasons. First, young children may be more sensitive to myopic triggers from the environment. Such age effects have also been found in the Sydney Adolescent Vascular and Eye Study.⁷ In this study, children who developed myopia spent 1.5 hours more on near work than children without myopia, but this was only in the younger cohort of 6-year-old participants and not in the older cohort of 12-year-old participants.⁷ The sensitivity may have a statistical origin. Growth curves of axial length (<http://www.myopie.nl>) and refractive error charts are much steeper at ages 6 to 9 years than older ages, demanding less power to find statistically significant associations. Secondly, older age groups spent less time outdoors and increased time on near-work activities even before the national lockdown. Their behavioral exposure was already abundant. Of course, we cannot rule out chance from this single study.²

In conclusion, 2020 will be a memorable year for many reasons. The quarantine measures were and still are important and our best bet to reduce the spread of the virus. Nevertheless, an intelligent lockdown might need to consider careful planning of indoor activities and preferably not restrict outdoor play in young children. That may help control a wave of quarantine myopia.

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