The article by Zhang and colleagues, using data from the Hong Kong Children Eye Study, presents a detailed picture of the associations between myopia and exposure to secondhand smoking (SHS) in children aged 6 to 8 years. Exposure to SHS was associated with greater myopic refraction, longer axial length, and earlier onset of myopia. The statistically significant effect sizes were small, but consistent, and showed a dose-response association with severity of exposure and younger age. Every increase in units of 10 cigarettes per day was associated with 0.07D more myopia, and overall exposure to SHS was associated with 1.8 months earlier onset of myopia. The data were internally consistent, with the differences associated with exposure to SHS in spherical equivalent refraction and axial length consistent with biological explanations. This analysis shows the power of analyzing factors associated with the risk of myopia in a well-designed study that uses a large sample of children of a similar age, to minimize age-related confounding, and that uses systematic cycloplegia, a combination that is unfortunately all too rare in studies from East Asia at the moment. Performing such studies is hard work, primarily in persuading parents to give informed consent, but the effort pays off. This study is the most precise evidence of an association between exposure to SHS and myopia in children currently available.

A recent review of factors associated with the risk of myopia concluded that previous studies have given conflicting results on smoking, probably owing to uncontrolled confounding. Although the study by Zhang et al is cross-sectional and, therefore, cannot prove a causal relationship, cross-sectional studies can provide the starting point for generating testable hypotheses about causation. The existence of a dose-response curve is consistent with a causal relationship, but does not prove it. Pharmacological studies have shown that both cholinergic nicotinic agonists, such as nicotine, and nicotinic antagonists inhibit the development of experimental myopia; thus, a possible causal pathway is not well defined. Further longitudinal evidence would be particularly useful, but it is hard to imagine an ethics-approvable clinical trial in which children are randomized to receive SHS, so unless mendelian randomization provides additional information, the issue of causality may be hard to resolve.

The authors have tried to address the issue of confounding, with some detailed statistical analysis. In most studies, myopia is associated with higher socioeconomic status (SES), presumably owing to increased parental education, whereas smoking tends to be more common in lower SES groups. This pattern would suggest that exposure to SHS should tend to be associated with lower parental education and income, as the data in this article suggest, and less myopia in the children. However, there are also indications of a greater complexity to the issue in Hong Kong, since Choi et al have reported that myopia in Hong Kong is associated with constricted home environments, which is generally an indicator of lower SES, whereas Liang et al have reported that, when comparing children attending a local Hong school and those attending an international school, the children with wealthier, better educated, and more myopic parents who attended the international school were much less myopic than those in the local schools. Sorting out causal connections within such a complex pattern of associations is inevitably challenging, and confounding has not been ruled out.

The authors suggest that, “eliminating SHS exposure is important for myopia prevention among children, particularly in families with young children.” Putting to one side the implicit assumption of...
a causal relationship, there are a number of other issues with this statement. All of the effect sizes reported for SHS exposure were small, compared with age effects. Other data from the Hong Kong Children Eye Study² show that from the age 6 to 8 years, mean spherical equivalent refraction changes from 0.60 to −0.30, for a total of change of −0.90D. Compared with refraction in their parents, with a mean refraction of −2.71D, the shift from the mean of 0.60D at age 6 years implies a total change of −3.3D.² These data are very consistent with data from other countries with a myopic epidemic. Compared with these large changes with age, the difference of 0.08D associated with exposure to SHS in the study by Zhang et al³ is small. Further data on students at the end of schooling will be required to see whether the differences in refraction associated with exposure to SHS are larger at this stage, but some of the analyses in this article suggest a decline in the difference with age, even over the small age range currently analyzed.

The fact that Hong Kong now has one of the highest myopia prevalence rates in the world, but one of the lowest smoking rates, does not suggest that smoking, or exposure to SHS, plays a major causal role in relation to myopia. For that reason, without in any way arguing against attempts to further lower smoking rates, this may not be the best way of addressing the myopia problem in Hong Kong.

Hong Kong’s high educational performance in the Organisation for Economic Cooperation and Development’s Program in Secondary Assessment studies⁷ is likely to be much more relevant to the high prevalence of myopia, given that all the countries with a high prevalence of myopia share this characteristic. Fortunately, some school systems manage to achieve high educational outcomes without generating high levels of myopia. Changing how schools operate, to preserve the high educational outcomes, while eliminating myopia is now the aim, and increased time outdoors is now recognized as the best way to slow the onset of myopia, with the causal connection well documented.⁸ This approach has an explicit place in the myopia control strategies of Singapore, mainland China, and Chinese Taipei or Taiwan.⁴ Using this strategy of aiming for 2 hours per day outdoors, reductions in the prevalence of myopia of 40% to 50% at the preschool and early primary school level in Taiwan have recently been reported.⁹

The authors of this study¹ are clearly aware of this issue, since they have discussed the importance of time outdoors in several of their analyses and adjust for time outdoors in a number of analyses in the current study. Unfortunately, there is little sign that the potential for increased time outdoors to control the development of myopia is recognized officially. Hong Kong, as is well known, is governed by the principle of 1 country, 2 systems, and this includes 2 school systems. At least in this respect, Hong Kong would be well-advised to look at what is happening in mainland China, just across the border, where President Xi made control of the myopia epidemic a major issue as far back as 2018,¹⁰ and where there have been major reforms to the school system and how schools operate. There are also many lessons to be drawn from Singapore and Taiwan.


