

# Eliminating doubts of time outdoors as a significant intervention to reduce the prevalence of myopia

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We thank Dr. Li Deng *et al.* and Dr. Enis Kocak *et al.* for their comments on our previous study of outdoor time and myopia development. Clearly, as noted in Dr. Li Deng *et al.*'s paper, we did not measure the academic performance of subjects or near work time in the trial. Though these are important confounders of myopia, their effect may be considerably reduced by randomization in the study. We also agree that the questionnaire measurement of outdoor time outside school hours forms a limitation, as noted by Dr. Enis Kocak *et al.*, and accept that this was the most cost-effective examination for a trial of this size at that time. Moreover, the outdoor activity time between the two groups was not significantly different at baseline. Recent developments in real-time and objective monitoring through the use of mobile devices may be incorporated into future studies to reduce reporting bias.

Dr. Li Deng *et al.* proposed that the findings of this study may not be generalizable to children living in rural areas and of different ethnicities. The epidemiology studies of myopia highlight the differences in prevalence between urban and rural areas (1-4). One hypothesis for this has been that rural children spend more time outdoors. The Sydney Myopia Study data accounted for ethnicity differences in myopia and time spent outdoors, finding that children from European Caucasian ethnicity who spend more time in outdoor activities suffered lower incidence of myopia when compared to those from East Asian ethnicity (5). This evidence supports that increased time outdoors is most likely to benefit school-age children living in urban areas originating from East Asia.

Dr. Enis Kocak *et al.* made the interesting point that increasing outdoor exposure time is not an optimal solution

for the myopia epidemic. Indeed in our study, the amplitude of reduction in refraction was relatively small, however, as we have discussed in the paper the relationship between time outdoors and myopia appears to be dose-responsive. Additional time spent outdoors, such as 90 minutes for instance (5), may significantly contribute to reducing the prevalence of myopia to a more controllable level. Moreover, according to general population data, the annual progression of refraction in children aged 6-9 years is estimated at 0.2 D per year (6), and therefore the effect power of time outdoors may sufficiently to retard progression for the majority of school-aged children. Dr. Enis Kocak concluded that increasing time outdoors produces a small effect in contrast to the outcomes of studies using optical corrections or antimuscarinic drops. Most trials concerning optical corrections or antimuscarinic drops recruited only myopic subjects (7,8), while outdoor time trials additionally highlight the protective effect on non-myopic children. Furthermore the changes in different phases of refractive progression cannot be directly compared as myopia progression is not linear (9). We also wish to emphasize that most children achieve myopia stabilization at around 15 years of age, and delaying the age of myopia onset may shorten the duration of myopia progression, reducing the prevalence of pathological high myopia without potentially severe side effects. Promoting additional time spent outdoors for children is a low-cost intervention and is a message that may complement other public health initiatives aimed at reducing the impact of sedentary lifestyles.

As pointed out by Dr. Enis Kocak *et al.*, we used auto-refraction data in our analysis. Cycloplegic auto-refraction

has been proved to be comparative with streak retinoscopy in many studies (10,11), and children in primary school were cooperative with completing the examinations on table-mounted autorefractors. The quality-control procedure of auto-refraction measurement was documented in the study protocol and was strictly adhered to. Cycloplegic auto-refraction is commonly adopted in epidemiologic studies at present, and we would not consider this a significant limitation of the trial.

I thank the editor for the opportunity to respond to the two papers and hope our response clarifies the objectives and findings of the article.

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### Footnote

*Conflicts of Interest:* The author has no conflicts of interest to declare.

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