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Increased Time Outdoors Is Followed by Reversal of the Long-Term Trend to Reduced Visual Acuity in Taiwan Primary School Students

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Purpose: To investigate the change in the prevalence of reduced visual acuity (VA) in Taiwanese school children after a policy intervention promoting increased time outdoors.

Design: Prospective cohort study based on the Taiwan School Student Visual Acuity Screen (TSVAS) by the Ministry of Education in Taiwan.

Participants: All school children from grades 1 through 6 were enrolled in the TSVAS from 2001 through 2015.

Methods: The TSVAS requires each school in Taiwan to perform measurements of uncorrected VA (UCVA) on all students in grades 1 through 6 every half year using a Tumbling E chart. Reduced VA was defined as UCVA of 20/25 or less. Data from 1.2 to 1.9 million primary school children each year were collected from 2001 through 2015. A policy program named Tian-Tian 120 encouraged schools to take students outdoors for 120 minutes every day for myopia prevention. It was instituted in September 2010. To investigate the impact of the intervention, a segmented regression analysis of interrupted time series was performed.

Main Outcome Measures: Prevalence of reduced VA.

Results: From 2001 to 2011, the prevalence of reduced VA of school children from grades 1 through 6 increased from 34.8% (95% confidence interval [CI], 34.7%−34.9%) to 50.0% (95% CI, 49.9%−50.1%). After the implementation of the Tian-Tian 120 outdoor program, the prevalence decreased continuously from 49.4% (95% CI, 49.3%−49.5%) in 2012 to 46.1% (95% CI, 46.0%−46.2%) in 2015, reversing the previous long-term trend. For the segmented regression analysis controlling for gender and grade, a significant constant upward trend before the intervention in the mean annual change of prevalence was found (+1.58%; standard error [SE], 0.08; $P < 0.001$). After the intervention, the trend changed significantly, with a constant decrease by −2.34% annually (SE, 0.23; $P < 0.001$).

Conclusions: Policy intervention to promote increased time outdoors in schools was followed by a reversal of the long-term trend toward increased low VA in school children in Taiwan. Because randomized trials have demonstrated outdoor exposure slowing myopia onset, interventions to promote increased time outdoors may be useful in other areas affected by an epidemic of myopia. *Ophthalmology 2020;127:1462-1469 © 2020 by the American Academy of Ophthalmology. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).*

See Commentary on page 1470.

Currently, more than 20% of the global population is myopic, affecting approximately 1.4 billion people, of which 163 million have high myopia.[1] By 2050, some projections suggest that approximately 50% of the world's population will be myopic (approximately 5 billion people) and 1 billion people will be highly myopic (−5 diopters), with an increased risk of visual impairment and blindness. In Taiwan, the prevalence of myopia is up to 84% in high school students, and the prevalence of high myopia is as high as 24%.[2] The increase in the prevalence of myopia and high myopia appear to be linked. As the prevalence of myopia has risen, the age of onset has decreased, allowing more time for myopia to progress toward high, pathologically significant myopia, with increasing progression rates.

Visual acuity (VA) screening in schools is used widely to detect eye problems, including refractive errors in school children.[3] For myopia detection, uncorrected VA (UCVA) has a high correlation (0.992) and high sensitivity and specificity (97.8% and 97.1%, respectively).[4,5] Therefore, the prevalence of reduced VA may serve as an approximate surrogate measure of the prevalence of myopia.

From 1980, the Administration of Executive Yuan (Taiwan Central Government) instructed relevant departments to initiate the Enhance Important Measures of Student Vision Care program, which required student VA screening by school nurses each semester in all schools in Taiwan. Students with UCVA of 20/25 or worse in any eye would require a referral to the ophthalmologist. From 1999, the Executive Yuan−led Ministry of Education, Department

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of Health, Ministry of the Interior, and associated departments conducted the Enhancing School Children Vision Care 5-Year Program. The strategies for myopia prevention included improving classroom lighting, adjusting table height, encouraging gazing into the distance, promoting near-work breaks, and encouraging eye exercises. However, the prevalence of reduced VA continued to deteriorate, and from 2007 through 2009, the Ministry of Education established the School Children and Preschool Vision Care Program. During the vision care advisory council meeting within the Ministry of Education in 2009, one of the authors (P.-C.W.) proposed that outdoor activities be promoted as a priority to reduce the prevalence of myopia, in accordance with the most recent research evidence.[6–8] The Ministry of Education adopted this suggestion, and subsequently, the Tian-Tian 120 program to promote outdoor activities for 120 minutes every day was added as the most important strategy for myopia prevention in the Taiwan School Children Vision Care Program, from the beginning of the new school year in September 2010 (Fig 1). In this study, we aimed to investigate the changes in the prevalence of reduced VA in Taiwan school students over a 15-year period before and after promoting time outdoors.

Methods

The Ministry of Education in Taiwan has required every school to perform a VA examination by the school nurse for each student every semester since 1980. We performed the analysis using data obtained from the annual reports of the Taiwan School Student Visual Acuity Screen (TSVAS) conducted from 2001 through 2015.[9] All study participants were primary school students between 7 and 12 years of age. The study adhered to the tenets of the Declaration of Helsinki, and approval from the institutional review board or ethics committee was obtained (identifier, 201801041B0).

Uncorrected VA was measured for the right and left eyes using a Tumbling E chart, with illumination of the examination rooms maintained at approximately 500 lux. The child was asked to indicate the direction of the E optotype within 5 seconds and was observed closely for squinting. Measurements began at a distance of 6 m with the bottom line (20/20) and used a staircase protocol. The lowest line read successfully determined the VA for the eye. If the top line was not read, the distance was decreased to 3 or 1 m. Each school nurse was trained to use a uniform protocol for VA examinations, which was used throughout the study years. Visual acuity with glasses also was measured. Normal VA was defined as UCVA better than 20/25. Reduced VA was defined as UCVA of 20/25 or worse in either eye. For example, a student with UCVA of 20/200 in one eye and 20/20 in the other eye was defined as having reduced VA. Participants wearing contact lenses or receiving orthokeratology therapy also were tested, but they were defined as having reduced VA.

Between 2001 and 2010, the key elements of the campaign for myopia prevention were encouraging gaze into distance, eye exercise involving massage surrounding the orbital rim, ensuring that the classroom light intensity was at least 500 lux, changing the table height according to the student's height, and near-work breaks (3010 rule: 30 minutes followed by a 10-minute break during near-work activities). From studies at that time, Jones et al[7] reported that if children with 2 myopic parents have 14 hours per week of outdoor activity, then the risk of myopia developing would be as low as that of the children without myopic parents. Rose et al[10] compared myopic school children in Sydney and Singapore. The prevalence of myopia in 6- and 7-year-old children of Chinese ethnicity was significantly lower in Sydney (3.3%) than in Singapore (29.1%; $P < 0.001$). Children in Sydney spent more time on outdoor activities (13.75 hours per week vs. 3.05 hours per week; $P < 0.001$), which was the most significant factor associated with the differences in the prevalence of myopia between the 2 sites. Based on this, it seems that 14 hours per week of outdoor activity could prevent myopia onset; therefore, 2 hours of outdoor activities per day was suggested as a national intervention. The program promoting 120 minutes outdoors was called Tian-Tian Outdoor 120. From September 2010, time outdoors was the focus of the campaign for myopia prevention. The slogan Tian-Tian Outdoor 120 was intended to encourage the students to perform outdoor activities for at least 120 minutes per day both at school and at home.

The correlation of prevalence of reduced VA with that of myopia also was investigated. This was assessed by comparing the prevalence of reduced VA from TSVAS in 2006 with the prevalence of myopia determined by cycloplegic autorefraction (≥ -0.25 D) in the Taiwan Myopia Survey (TMS). The TMS adopted a systematic stratified cluster sampling method, and the result was published in Mandarin as an official government report.[11]

Statistical analyses were performed with IBM SPSS statistics software version 22.0 (IBM Corp, Armonk, NY). A Student *t* test was used to compare the annual changes in reduced VA ratio before and after the implementation of outdoor activities. Multiple linear regression analysis was used to compare the regression coefficients between 2 groups.

To explore the effect of the intervention in the prevalence of reduced VA, a segmented regression analysis of interrupted time series was performed using the method of Wagner et al.[12] We calculated (1) the β0 coefficient, which estimates the prevalence at the beginning of the observation; (2) the β1 coefficient, which estimates the baseline prevalence trend; (3) the β2 coefficient, which estimates the change in prevalence during the intervention; and (4) the β3 coefficient, which represents the change in the slope of the trend of prevalence after the start of the intervention:

$$Y_t = \beta_0 + \beta_1 \times \text{time}_t + \beta_2 \times \text{intervention}_t + \beta_3 \times \text{time after intervention}_t + e_t.$$

Pearson's correlation coefficient (*r*) was used to compare the prevalence of reduced VA and that of myopia. All statistical tests were 2-sided, and *P* values less than 0.05 were considered statistically significant.

Results

The basic characteristics of the schools and students studied are shown in the left panel of Table 1. From 2001 through 2015, the enrollment ratio among primary school students in TSVAS was always more than 90% and generally was 98% to 99%. More than 2600 schools and approximately 1.2 to 1.9 million students were enrolled annually in the visual assessment program. Approximately 48% of participants were female.

The prevalence of reduced VA of all the students and different age groups is shown in the right panel of Table 1. The patterns of change over the periods are shown in Figure 2. From 2001 through 2010 (before the outdoor promotion period), the prevalence of reduced VA of school children from grades 1 through 6 in primary schools increased progressively from 34.80% (95% confidence interval [CI], 34.73%–34.87%) to 49.10% (95% CI, 49.02%–49.18%). Outdoor activities for myopia prevention were implemented from September 2010 (after the outdoor promotion period). Although the reduced VA prevalence reached its highest, 50.01% (95% CI, 49.93%–50.09%) in 2011, thereafter, it declined continuously from 49.36% (95% CI, 49.28%–49.45%) to 46.12% (95% CI, 46.03%–46.21%)

Figure 1. Photographs showing how schools implemented the Tian-Tian Outdoor 120 program to increase time outdoors, in which students performed outdoor activities during recess at the school.

from 2012 through 2015. Before the outdoor promotion period, the mean annual change in reduced VA ratio in school children in grades 1 through 6 was +1.59 ± 0.57%. In contrast, it became −0.59 ± 0.87% in the period after the outdoor promotion. The observed change was statistically significant ($P < 0.001$).

For the analysis by each 5-year period, the change in prevalence from 2011 through 2015 was −3.99% (50.11% declined to 46.12%). By comparison, during the previous 5-year period from 2006 through 2010, the change was +6.06% (43.04% increased to 49.10%). The total difference in these 2 periods before and after the policy intervention is 10.05% (3.99% + 6.06%) in the 5 years from 2011 through 2015. Therefore, the reduction rate after intervention was approximately 20.5% over 5 years (10.05% / 49.1%) and 4.10% per year.

For the different age groups shown in Figure 3, senior primary school children (grades 4−6, ages 10−12 years) showed a higher prevalence of reduced VA in comparison with junior primary school children (grades 1−3, ages 7−9 years). Both groups showed similar changing patterns in the periods before and after the outdoors promotion. Significant differences were found in the mean annual change in reduced VA ratio between the periods before and after the outdoor promotion in both junior and senior groups (+1.08±0.65 vs. −0.68±0.60 in junior group and +1.87±0.66 vs. −0.25±0.93 in senior group; both $P < 0.001$). In the period after the outdoor promotion, the younger group showed a larger decline in slope than the older group ($P = 0.002$).

Table 1. Enrolment Number, Ratio, Gender Ratio, and Prevalence of Reduced Visual Acuity in Taiwanese School Children

School Year	No. of Primary Schools	No. of Students in Grades 1−6	Percentage of Enrollment	Female (%)	Reduced Visual Acuity (%)			
					Grades 1−6	*grades 1−3*	*Grades 4−6*	*Male/Female*
2001	2611	1 900 287	98.69	47.85	34.80	27.74	41.92	32.67/37.13
2002	2627	1 804 253	94.07	47.80	35.77	28.46	43.10	33.73/38.00
2003	2638	1 740 616	90.99	47.77	36.55	28.85	44.26	34.54/38.76
2004	2646	1 874 293	99.51	47.79	38.95	31.04	46.59	36.96/41.14
2005	2655	1 728 093	94.33	47.84	41.14	32.70	48.94	39.12/43.35
2006	2651	1 774 981	98.70	47.88	43.04	33.41	51.63	40.90/45.37
2007	2651	1 738 303	99.10	47.86	44.89	34.76	54.06	42.97/46.98
2008	2654	1 663 822	99.19	47.84	46.70	36.27	56.30	44.98/48.58
2009	2658	1 575 446	98.87	47.79	47.86	37.23	57.30	46.30/49.57
2010	2661	1 510 343	99.38	47.73	49.10	37.43	58.72	47.71/50.61
2011	2659	1 449 090	99.46	47.72	50.01	37.78	59.95	48.89/51.24
2012	2657	1 366 870	99.53	47.71	49.36	36.58	60.05	48.41/50.41
2013	2650	1 291 529	99.57	47.69	48.11	35.65	59.15	47.33/48.96
2014	2644	1 246 849	99.53	47.68	47.05	34.71	58.35	46.47/47.69
2015	2633	1 208 990	99.56	47.72	46.12	34.05	57.47	45.51/46.79

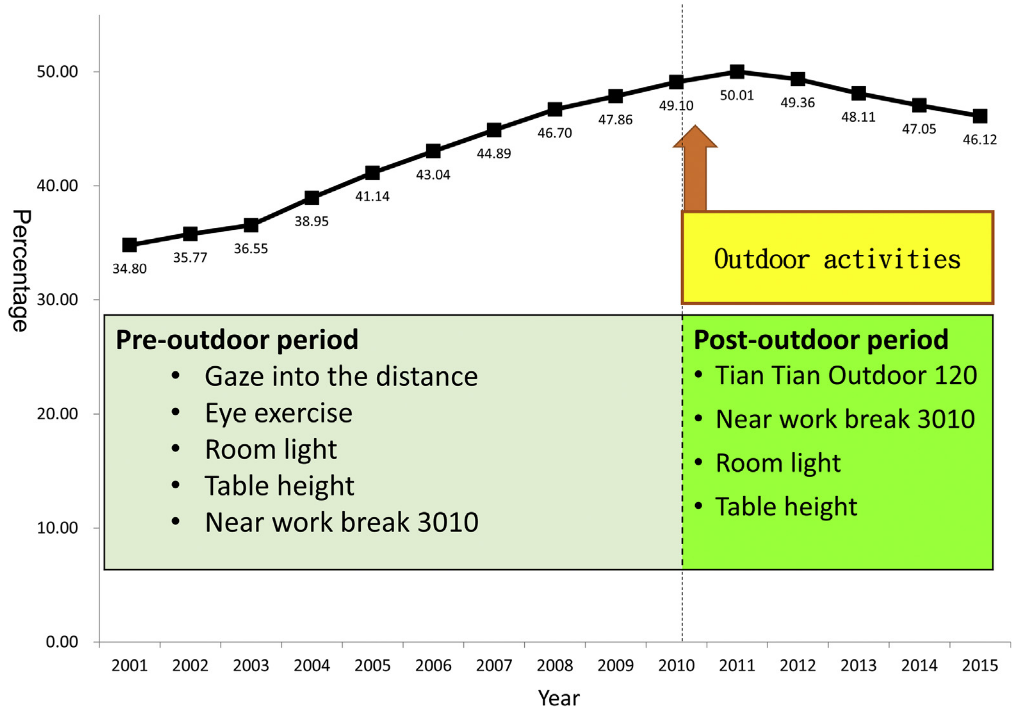

Figure 2. Graph showing the prevalence and pattern of reduced visual acuity (20/25 or worse in either eye) in primary school children in Taiwan from 2001 through 2015. Data from more than 1 million school children were collected annually. Vertical dashed line indicates the beginning of the intervention of outdoor activities for myopia prevention. The key elements of the campaign for myopia prevention from 2001 through 2010 were encouraging gaze into distance, eye exercise and massage surrounding the orbital rim, ensuring that the classroom light intensity was at least 500 lux, changing the table height according to a student's height, and near-work breaks (3010 rule: 30 minutes followed by a 10-minute break during near-work activities). After 2010, time outdoors was the priority of the campaign for myopia prevention. The slogan Tian-Tian Outdoor 120 was used to encourage the students to perform outdoor activities for at least 120 minutes per day.

Interrupted time series regression analysis of the prevalence (percent) of reduced VA is shown in Table 2. Before the policy intervention, a significant constant upward trend in the prevalence was found, with a slope of +1.72 (standard error [SE], 0.05, $P < 0.001$). After the intervention, the prevalence trend line reversed significantly, constantly decreasing by −2.73 (SE, 0.16; $P < 0.001$). After controlling for gender and grade, the trend lines of before and after the intervention still showed a statistically significant difference (+1.58 [SE, 0.08; $P < 0.001$] and −2.34 [SE, 0.23; $P < 0.001$], respectively).

The prevalence of reduced VA corresponded to the prevalence of myopia (Fig 4). The prevalence from the TSVAS and TMS were similar and showed a high correlation coefficient of 0.993 ($P < 0.001$). This suggests that the prevalence of reduced VA in our study is an appropriate proxy for the prevalence of myopia in large-scale studies of this kind.

Discussion

This study showed that the implementation of a program of increased outdoor activities as a governmental policy was followed by a reversal of the secular trend toward an increased prevalence of lower VA associated with the myopia boom in Taiwanese school children. The trend reversal was observed in both younger and older populations of primary school children, although the effect in the younger population was more significant.

Several studies have shown that the prevalence of reduced VA is a predictor of the prevalence of myopia, including the Guangzhou Refractive Error Study in Children (RESC), the Singapore Cohort Study of the Risk Factors for Myopia (SCORM), and the Sydney Myopia studies.[3,4,13] This also was seen in the tight correlation between the results of the TSVAS and TMS surveys in Taiwan. Consistent with these studies, the changes in the prevalence of reduced VA over this 15-year period seem largely to be the result of the changes in the prevalence of myopia in Taiwan. Participation in TSVAS in Taiwan was compulsory, so the participation was extremely high and large data sets (more than 1 million student VA data per year) were obtained. The enrollment rate was 90% to 99% of all school children in Taiwan, which excludes selection bias. The data were collected with a standard protocol used for the entire 15-year period, whereas the TMS collected comparatively limited data, and its design was a stratified systematic cluster to minimize selection bias. The prevalence of reduced VA in TSVAS therefore can be considered a proxy indicator of the prevalence of myopia in school children in Taiwan.

A marked increase was found in the prevalence of reduced VA of school children in Taiwan from 2001 through 2010. In 2001, less than 35% of the children showed reduced VA, compared with half in 2010. The trend

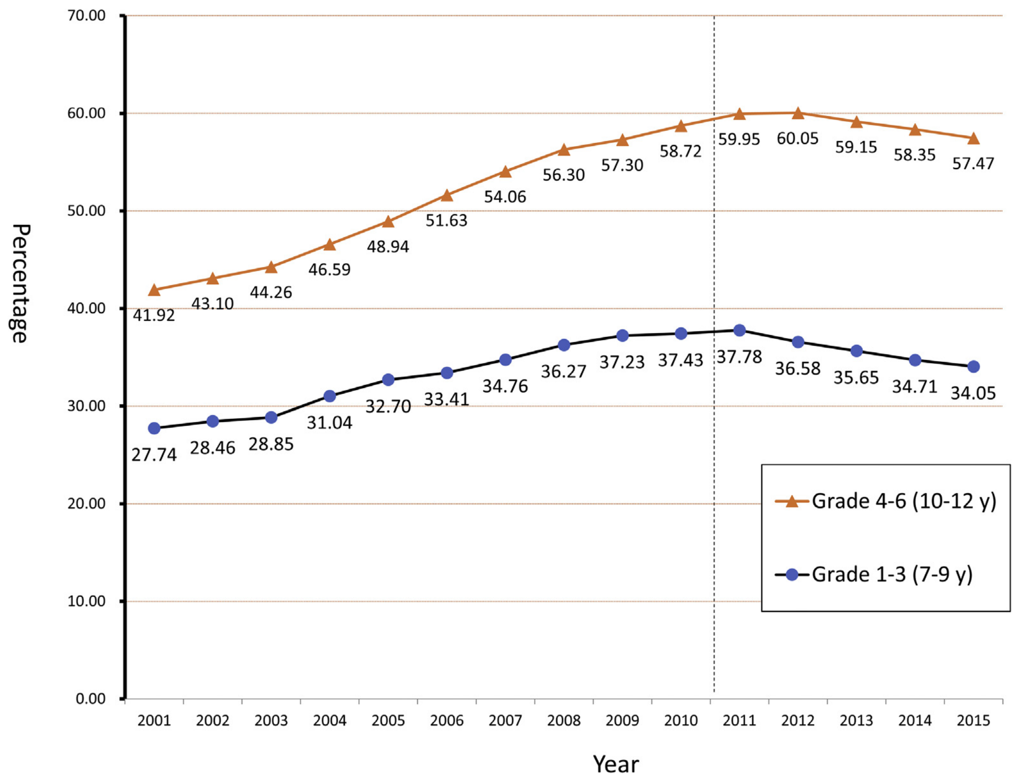

Figure 3. Graph showing the prevalence of reduced visual acuity (20/25 or worse) in different age groups of primary school children in Taiwan from 2001 through 2015. Vertical dashed line indicates the beginning intervention of outdoor activities for myopia prevention.

was continuous and increased in parallel with the increasing prevalence of myopia from 1983 through 2000 seen in the TMS.[14] Similar patterns of secular change were observed for both senior and junior school children; the senior group showed a consistently high prevalence of reduced VA, consistent with the higher prevalence of myopia. In this period, the increase in prevalence of myopia largely may be the result of environmental changes in Taiwan associated with compulsory education and economic growth.[15] The continuous decrease in the population of primary school children with low birth rate should be noted.[16] It may be that as family sizes decreased, parents might have placed more emphasis on academic success on the fewer children in a family. Morgan and Rose[17] demonstrated that high performance in the Program for International Student Assessment (PISA) international surveys of student achievement performance were associated with a high prevalence of myopia, suggesting that heavy study loads may be an important factor. Over this period, approximately 97% of the population in Taiwan

Table 2. Segmented Regression Model Analysis of the Prevalence (%) of Reduced Visual Acuity

Variable	Coefficient	Standard Error	*t* Statistic	*P* Value
Total				
Intercept (β_0)	−3406.43	105.84	−32.19	<0.001
Baseline trend (β_1)	1.72	0.05	32.58	<0.001
Level change after intervention (β_2)	1.54	0.58	2.67	0.022
Trend change after intervention (β_3)	−2.73	0.16	−16.99	<0.001
Controlling gender and grade				
Intercept (β_0)	−3155.06	149.94	−21.04	<0.001
Gender (male = 1, female = 0)	−3.10	0.35	−8.84	<0.001
Grade	6.46	0.10	62.96	<0.001
Baseline trend (β_1)	1.58	0.08	21.18	<0.001
Level change after intervention (β_2)	0.85	0.82	1.04	0.301
Trend change after intervention (β_3)	−2.34	0.23	−10.28	<0.001

The parameters show the results of a segmented regression that estimated the prevalence of reduced visual acuity in each observation period. The model considers the prevalence to be a baseline intercept and trend from 2001, a change after the policy intervention of the outdoor program (Tian-Tian Outdoor 120) began, and a trend change after the intervention: $Y_t = \beta_0 + \beta_1 \times \text{time}_t + \beta_2 \times \text{intervention}_t + \beta_3 \times \text{time after intervention}_t + e_t$.

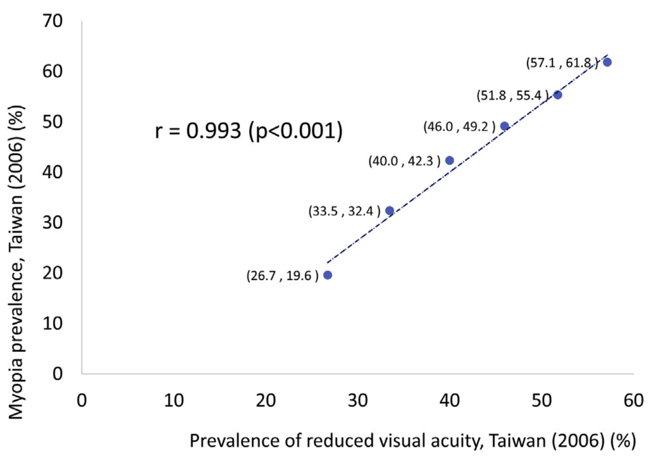

Figure 4. Graph showing the comparison of the prevalence of reduced visual acuity from the Taiwan School Student Visual Acuity Screen in 2006 and prevalence of myopia from the Taiwan Myopia Survey in 2006.

was of Han Chinese background, suggesting that changes in gene pools could not account for the changes observed.

For the past 3 decades, the Taiwan government has prioritized the prevention of myopia with its school children vision care program. A Taiwan student vision screening system, tightly linked to referral for correction, has been established and a large budget has been allocated for myopia prevention. The Executive Yuen instructed several government departments, including the Health Department and the Ministry of Education, to conduct the Enhance School Children Vision Care 5-Year Program from 1999. The strategies in this program included room lighting improvement to 500 lux, table height adjustment according to a student's height, encouragement of distance gazing during recess (inside the classroom), promoting near-work break habits, and encouraging eye exercises during recess inside the classroom. After the end of the 5-year program, the aforementioned strategies were promoted continuously until 2010. At that time, the environmental factors had not been well identified. Only the long duration of near work had been recognized as an important risk factor.[18] However, the strategy of the governmental program for myopia prevention was not effective before 2010, and the prevalence of myopia increased continuously.

After September 2010, outdoor activity was added and promoted as the priority, based on recent evidence.[6−8] Although the Tian-Tian Outdoor 120 program was encouraged strongly, it was not made compulsory. Because the governmental campaign of myopia prevention in schools had been well established for decades, changing from promoting distance gazing to promoting outdoor activities was practical and executable for schools. In recent years, taking recess outside the classroom also was promoted to reach the recommended 120 minutes of daily outdoor time.[8,19] In addition, an initiative called Sport & Health 150 was undertaken according to the National Sports Act, a law that promoted an additional 150 minutes of exercise per week since December 2013. After implementation of the outdoor activities program, the prevalence of reduced VA decreased from 2012 through 2015 by approximately 1% per year. This means that more than 10 000 school children every year retained their normal vision without becoming myopic. It might have helped them to avoid becoming highly myopic later in life and might have decreased the risk of blindness. Recently, more evidence, including the results of randomized intervention trials, has demonstrated the protective effect of outdoor activities for myopia.[19−21] Our results on the governmental outdoor program suggest that this strategy can be implemented on a large-scale, nationwide basis.

The change in prevalence of reduced VA from 2011 through 2015 was −3.99%. In comparison, that during the previous 5-year period (2006−2010) was +6.06%. Despite the clear reversal of a long-term trend of worsening vision, the prevalence of reduced VA was still as high as 46.2% in 2015. Time outdoors seems effective in decreasing reduced VA prevalence; however, it still needs long-term promotion and investigation to determine whether it could continue to achieve lower prevalence in the future. Lin et al[2] reported that the prevalence of myopia in 7-year-old children showed an 8% increase from 1995 through 2000 and a 5% increase in 12-year-old children. Thus, we can extrapolate and set the targeted reduction of prevalence of reduced VA to up to 5% to 8% during 5-year period.

The limitations of this study included that some confounding factors could not be controlled, such as school size and school compliance. Although the government myopia prevention program and policy were promoted strongly to all schools in Taiwan from 1999 until now, the compliance of each school may vary. Factors such as parent myopia status, socioeconomic status, and outdoor time achieved could not be controlling because of a lack of information. In addition, despite high correlation, the prevalence of reduced VA is a highly correlated proxy for the prevalence of myopia. The Tian-Tian Outdoor 120 program was introduced as a national health intervention and, as is generally the case with policy interventions, was applied to the entire population, without a randomized control group. This means that we cannot conclude definitively that the decrease in reduced VA was caused by the policy intervention. However, this policy was introduced because of the evidence of a negative association between the prevalence of myopia and the amount of time that children spend outdoors in both cross-sectional and longitudinal studies, for which a plausible mechanism exists involving increased dopamine release from the retina with brighter light outdoors. A causal role for increased time outdoors has been confirmed since in randomized intervention trials, and the mechanism of the protective effect has been confirmed in animal experiments on experimental myopia. A direct effect of the policy change thus seems to be a highly plausible interpretation of the reduction in reduced VA that followed the evidence-based intervention. This is supported strongly by the correlation between the introduction of the policy and the reversal of the long-term trend. However, it is worth considering whether other factors could be involved. As noted previously, other changes to programs within schools have occurred, including the promotion of increased physical activity from 2014. Although physical activity per se does not seem to prevent myopia, if it is performed outdoors, as it often is, this policy change might have contributed to the reductions observed. It is also important to consider whether the widespread use of atropine eye drops to control the progression of myopia in Taiwan could have contributed to the effect. This seems unlikely because, although atropine has been shown to slow the development of myopia in premyopes (refractive error between +0.5 and −0.5 diopter) in 1 small trial, atropine is prescribed only for children with diagnosed myopia, and thus it should not affect the prevalence of myopia or the surrogate measure of reduced VA. Atropine is an effective therapy for the reduction of progression of myopia in myopic children; however, it was prescribed only for students who already have myopia during this period in Taiwan, not for the prevention of myopia in students with normal VA. The widespread use of atropine eye drops in Taiwan begun in the last century to the early 2000s, far earlier than 2011, but the prevalence of myopia still increased from 2001 through 2010 and decreased only after the promotion of outdoor activity for 120 minutes daily in 2010. Therefore, the decrease in myopia prevalence in Taiwan students seems to be caused mainly by the promotion of outdoor activities in students in this area.

So far, increased time outdoors is the only intervention that has been proven to reduce the onset of myopia in randomized trials. The case for increased time outdoors is strengthened by the proposed evidence-based mechanism that has been supported by animal experimentation. Increasing outdoor activity is a relatively simple, free, effective, and practical strategy, although it may face barriers to implementation in high-pressure education systems of the kind seen in many parts of East and Southeast Asia. Our results show that this sort of intervention can be introduced in such contexts and suggest that increased time outdoors is an approach to the prevention of myopia that is worth wider consideration, ideally in combination with interventions to control progression of myopia.

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Abbreviations and Acronyms:

CI = confidence interval; **D** = diopters; **SE** = standard error; **TMS** = Taiwan Myopia Survey; **TSVAS** = Taiwan School Student Visual Acuity Screen; **UCVA** = uncorrected visual acuity; **VA** = visual acuity.

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